NOISE ELEMENT
OF THE
GENERAL PLAN
OF THE
CITY OF EL PASO DE ROBLES

APRIL, 1994

95 00336

RESOLUTION NO. 94-43

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF EL PASO DE ROBLES APPROVING GENERAL PLAN AMENDMENT 94-01 (NOISE ELEMENT UPDATE)

WHEREAS, the Noise Element of the General Plan was adopted in August, 1977 by Resolution 2151; and

WHEREAS, the Land Use Element of the General Plan was updated in August, 1991, changing much of the future noise environment that was anticipated by the 1977 Noise Element; and

WHEREAS, State Planning Law (Government Code Section 65300.5) requires that General Plans be internally consistent; and

WHEREAS, in order to comply with the State's internal consistency requirement, the City has initiated an update to the Noise Element; and

WHEREAS, at its meeting of February 14, 1994, the Planning Commission took the following actions:

a. Considered the facts and analysis, as presented in the staff report prepared for the proposed general plan amendment;

b. Conducted a public hearing to obtain public testimony on the proposed general plan amendment;

c. Based on the information contained in the initial study prepared for the proposed general plan amendment, unanimously found that there was no substantial evidence that it would have significant adverse effects on the environment and recommended that the City Council approve a Negative Declaration;

d. Recommended that the City Council approve the proposed general plan amendment; and

WHEREAS, at its meetings of March 1 and April 5, 1994, the City Council took the following actions:

a. Considered the facts and analysis, as presented in the staff report prepared for the proposed general plan;

b. Considered the recommendations of the Planning Commission;

c. Conducted a public hearing to obtain public testimony on the proposed general plan amendment;

d. Found that there was no substantial evidence that the proposed general plan amendment would have significant adverse effects on the environment and approved a Negative Declaration in accordance with the California Environmental Quality Act;

NOW, THEREFORE, BE IT RESOLVED, by the City Council of the City of El Paso De Robles, California, to adopt the Noise Element Update consisting of the Policy Document ("Volume I") attached as part of Exhibit "A" with the following revisions:

1. Implementation Measure 4.3(a) on page 4-2 shall be revised as follows:

    a. To add "for apartments" immediately following "development plan";

    b. To delete the second paragraph;

2. Implementation Measure 4.3(c) on page 4-2 shall be revised to replace "may" with "shall".

3. Implementation Measure 4.5 on page 4-3 shall be revised to read as follows:

    "If the Community Development Director or his/her designee determines, from substantial evidence based on analysis, that a proposed new noise-sensitive land use may be exposed to noise levels that exceed the standards in Section 3.3, notwithstanding the noise contour information in this Noise Element, an acoustical analysis meeting the requirements in Table 4-1 may be required."

BE IT FURTHER RESOLVED, by the City Council of the City of El Paso De Robles, California, that the Technical Reference Document ("Volume II") and Acoustic Design Manual ("Volume III") prepared in conjunction with the Policy Document ("Volume I"), also attached as part of Exhibit "A", not be adopted as part of the Noise Element but may be referred to as technical references in implementing the Noise Element.

PASSED AND ADOPTED THIS 5th day of April, 1994 by the following roll call vote:

AYES: Heggarty, Macklin, Martin, Picanco, and Iversen
NOES: None
ABSENT: None
ABSTAIN: None

MAYOR CHRISTIAN E. IVERSEN

ATTEST:

RICHARD J. RAMIREZ, CITY CLERK

ED\NOISE\RESO

NOISE ELEMENT OF THE GENERAL PLAN
CITY OF EL PASO DE ROBLES, CALIFORNIA

VOLUME I - POLICY DOCUMENT

APRIL, 1994

CITY COUNCIL:

Christian Iversen, *Mayor*
Duane Picanco, *Mayor Pro Tem*
Steve Martin, *Councilman*
Walt Macklin, *Councilman*
James Heggarty, *Councilman*

PLANNING COMMISSION:

Pete Dakin, *Chair*
Pat Crawford, *Commissioner*
Valerie Warnke, *Commissioner*
Ron Johnson, *Commissioner*
Gary Nemeth, *Commissioner*
Nick Ferravanti, *Commissioner*
Patrick Banakis, *Commissioner*

CITY STAFF:

Richard J. Ramirez, *City Manager*
Robert Lata, AICP, *Community Development Director*
Ed Gallagher, *City Planner (Project Planner)*

PREPARED WITH THE ASSISTANCE OF
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POLICY DOCUMENT-NOISE ELEMENT, VOLUME I

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EXECUTIVE SUMMARY

The City of Paso Robles Noise Element of the General Plan provides a policy framework for addressing potential noise impacts in the planning process. Its purpose is to minimize future noise conflicts. The Noise Element consists of an adopted Policy Document, supported by a Technical Reference Document and an Acoustical Design Manual.

The Policy Document includes maps showing the extent of noise exposure from the major noise sources in the city (roadways, airports, railways and industrial/commercial uses) along with the goals, policies and implementation program adopted by the city to reduce future noise impacts.

Among the most significant polices of the Noise Element are numerical noise standards that limit noise exposure within noise-sensitive land uses, and performance standards for new commercial and industrial uses that might adversely impact noise-sensitive land uses.

When the potential for adverse noise impacts is identified, mitigation is required to carry out standard noise mitigation packages. If standard measures are not adequate, the specific recommendations of an expert in acoustics will be required.

When mitigation is required, highest priority is given to avoiding or reducing noise impacts through site planning and project design, and lowest priority given to structural mitigation measures such as construction of sound walls and acoustical treatment of buildings.

The Technical Reference Document contains background information on the data and methods used to prepare noise exposure information and an inventory of the major noise sources in the city. Information about the measurement and effects of noise is also included in the document. The Technical Reference Document is intended to be a resource when evaluating the noise-related implications of a project.

The purpose of the Acoustical Design Manual is to provide city staff, developers, builders, and homeowners with a guide for reducing outdoor and indoor noise in relatively simple situations. The Manual contains standard noise mitigation packages which in some situations may be used in lieu of an acoustical analysis prepared by a professional.

1.0 INTRODUCTION

1.1 Purpose and Scope

The Noise Element of the General Plan is a planning document which provides a policy framework within which potential noise impacts may be addressed during project review and long range planning. This element has been adopted by Paso Robles in conformance with Section 65302 (f) of the California Government Code.

A Technical Reference Document (Volume II) provides detailed information concerning the methods used to define existing and future noise exposure within Paso Robles. The Technical Reference Document is not adopted as part of the Noise Element.

An Acoustical Design Manual (Volume III) is also provided. This manual provides standard noise mitigation packages which may be used under some circumstances to comply with the policies of the Noise Element without the need for an acoustical analysis. It also contains background information to assist staff and the general public in evaluating the effectiveness of proposed noise mitigation measures. The Acoustical Design Manual is also not adopted as part of the Noise Element.

The Noise Element is directed at minimizing future noise conflicts. In contrast, a noise ordinance focuses at resolving existing noise conflicts and can serve as a tool to carry out the policies in the Noise Element. A noise ordinance may be used to address noise levels generated by existing industrial, commercial and residential uses which are not regulated by federal or state noise level standards. The regulation of noise sources such as traffic on public roadways, railroad line operations and aircraft in flight is preempted by existing federal and/or state regulations, meaning that such sources generally may not be addressed by a noise ordinance. The Noise Element establishes policies and requirements to prevent noise conflicts from all of these sources.

The noise level standards of a noise ordinance should be compatible with the adopted policies of the Noise Element to achieve consistency in the implementation of noise control programs, and to provide industry with design criteria for future development or expansion.

According to the Government Code requirements, noise exposure information should be included in the Noise Element for the following major noise sources:

1. Highways and freeways
2. Primary arterials and major local streets
3. Railroad operations

4. Aircraft and airport operations
5. Local industrial facilities
6. Other stationary sources

The City has identified two classes of noise-sensitive uses as follows:

<u>Residential</u>: Consists of all types of residential development: single family, multiple family and residential uses as accessory to commercial and industrial uses. It is the City's policy that mitigation be required where five or more residential units on one site are impacted by adverse noise levels.

<u>Non-Residential</u>: Consists of the following land uses:

a. Schools;
b. Hospitals, nursing homes;
c. Churches;
d. Meeting halls, auditoriums, theaters, libraries;
e. Transient lodging - motels and hotels;
f. Playgrounds, parks;
g. Offices.

It is the City's policy that mitigation should be provided and may be required where non-residential noise-sensitive uses are impacted by adverse noise levels.

The reasons for having two classes of noise-sensitive land uses are as follows:

- Residential land uses are recognized by federal, state, and local levels of noise regulations as having a greater need for quieter environments than most working and recreational environments.

- Residential uses have outdoor activity areas whereas, with the exception of schools, playgrounds and parks, non-residential uses do not. Public schools are subject to compliance with state noise mitigation standards enforced by the Office of the State Architect. City policy allows for higher noise levels in parks and playground because of the higher ambient noise levels associated with outdoor recreation activities.

- Standard construction requirements contained within the City's adopted building codes will reduce exterior noise levels by 15 dBA; common construction practices for non-residential uses (e.g. heating and air conditioning, solid-core doors, weatherstripping) will provide an additional 5 dB of noise reduction. Most non-residential noise-sensitive land uses are located in areas with less than 60-65 dBA of noise and 15-20 dBA of noise reduction

will achieve interior noise levels at the City's standard of 45 dBA.

- As part of its efforts to attract and retain industrial and commercial business, as mandated by Goals #1 and 2 of the Land Use Element (1991), the City's policy is to seek market-based solutions and to minimize regulation. The Noise Element will be used to alert proponents of new development of non-residential noise-sensitive uses that interior noise level reductions may be necessary to provide the best environments for client satisfaction and worker productivity. However, the burden of choosing and implementing appropriate mitigation measures should fall on the business owners.

1.2 Authority

The contents of the Noise Element and the methods used in its preparation have been determined by the requirements of Section 65302(f) of the California Government Code and by the *Guidelines for the Preparation and Content of Noise Elements of the General Plan* prepared by the California Department of Health Services and included in the 1990 State of California *General Plan Guidelines*, published by the State Office of Planning and Research. The *Guidelines* require that major noise sources and areas containing noise-sensitive land uses be identified and quantified by preparing generalized noise exposure contours for current and projected conditions. Contours may be prepared in terms of either the Community Noise Equivalent Level (CNEL) or the Day-Night Average Level (L_{dn}), which are descriptors of total noise exposure at a given location for an annual average day. The CNEL and L_{dn} are generally considered to be equivalent descriptors of the community noise environment within plus or minus 1.0 decibel (dB). See Section 1.5 for definitions of the terminology used in this document.

1.3 Relationship to Other Elements of the General Plan

The Noise Element is related to the Land Use, Housing, Circulation and Open Space Elements of the General Plan. Recognition of the interrelationship of noise and these four mandated elements is necessary to prepare an internally consistent general plan and to initiate changes which will reduce noise exposure to acceptable levels in areas where noise presently exceeds the levels set forth by the adopted policies of the Noise Element. The relationship between these elements is briefly discussed below:

1. Land Use: Land Use Element (1991) Policy HAZ-1 calls for the City to *Arrange, develop, operate, and maintain land uses with the goal of protecting citizens and property from damage from ...noise...*

6. <u>New Development</u>: Projects requiring land use or building permits, but excluding remodelling or additions to existing structures. Also includes modifications to existing stationary noise sources that substantially increase noise levels.

7. <u>Noise level reduction (NLR)</u>: The arithmetic difference between the level of sound outside and inside a structure measured in decibels. For example, if the sound level outside a house is 70 dB and the level inside a room of the house is 45 dB, the NLR is 25 dB (70-45=25).

8. <u>Noise-Sensitive Land Use</u>:

   <u>Residential</u>: residential development

   <u>Non-Residential</u>: Consists of the following land uses:
   a. Schools;
   b. Hospitals, nursing homes;
   c. Churches;
   d. Meeting halls, auditoriums, theaters, libraries;
   e. Transient lodging - motels and hotels;
   f. Playgrounds, parks;
   g. Offices.

9. <u>Outdoor Activity Areas</u>: Patios, decks, balconies, outdoor eating areas, swimming pool areas, backyards of dwelling units and other areas which have been designated for outdoor activities and recreation.

10. <u>Stationary Noise Source</u>: Any fixed or mobile source not preempted from local control by existing federal or state regulations. Examples of such sources include industrial and commercial facilities and vehicle movements on private property (e.g., parking lots, truck terminals, auto race tracks, etc.)

11. <u>Transportation Noise Source</u>: Traffic on public roadways, railroad line operations and aircraft in flight. Control of noise from these sources is preempted by existing federal or state regulations. However, the effects of noise from transportation sources may be controlled by regulating the location and design of land uses affected by transportation noise sources.

2.0 THE NOISE ENVIRONMENT

2.1 Overview of Sources

Based on discussions with City staff and field studies conducted during the preparation of the Noise Element, it was determined that there are a number of potentially significant sources of community noise within Paso Robles, including traffic on state highways and arterial streets, railroad operations, airports, and stationary noise sources. The Technical Reference Document includes detailed discussions of the noise levels produced by these sources.

2.2 Methods Used to Develop Noise Exposure Information

Analytical noise modeling techniques in conjunction with actual field noise level measurements were used to develop generalized L_{dn} or CNEL contours for major sources of noise within Paso Robles for existing and future conditions.

Analytical noise modeling techniques generally make use of source-specific data, including average levels of activity, hours of operation, seasonal fluctuations, and average levels of noise from source operations. Analytical methods have been developed for many environmental noise sources, including roadways, railroad line operations, railroad yard operations, industrial plants and aircraft/airport operations. Such methods will produce reliable results as long as data inputs and assumptions are valid for the sources being studied.

The analytical methods used in the preparation of this Noise Element closely follow recommendations made by the State Office of Noise Control. Methods included the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model for roadway sources, the Wyle Laboratories method for determining railroad noise exposure, and the Federal Aviation Administration (FAA) Integrated Noise Model (INM) for the assessment of aircraft/airport noise sources. For industrial, commercial and other stationary sources identified for study, a combination of source-specific noise level data and accepted calculation procedures was used to characterize noise emissions based upon operational data obtained from source operators.

The noise exposure information developed during the preparation of the Noise Element does not include all conceivable sources of industrial or commercial noise within the City, but rather is a representative sampling of typical sources. The noise exposure information developed for the sources identified for study should be used only as an indicator of potential noise impacts when other, similar sources are considered.

2.3 Determining Noise Exposure and Mitigation for Specific Locations

The chart shown in Figure 2-1 illustrates where noise exposure information for a particular location may be found. Noise exposure information may be used to determine if a particular land use is consistent with the policies of the Noise Element, and whether or not noise mitigation should be required as a part of the project development process.

Table 2-1 shows the location of noise exposure contours along selected cross sections of major streets and highways. The figures in Table 2-1 should be adjusted, in the manner shown in Table 2-2, in areas with varying topography. Table 2-3 shows the location of noise exposure contours along the Southern Pacific Railroad.

Figure 2-2 is a flow chart which illustrates the process which should be followed to determine noise exposure and appropriate mitigation for residential uses. Non-residential uses are encouraged to follow the same procedure for interior space reductions. In order to protect the public health, safety and welfare, there may be instances in which the City may require noise barriers for non-residential uses such as parks and playgrounds.

It should be noted that an acoustical analysis prepared by a noise expert should only be required where noise levels appear to exceed the ability of standard noise reduction measures, as described in the Acoustic Design Manual (Volume III), to reduce exterior and interior levels to City-adopted standards.

FIGURE 2-1

CHART FOR LOCATING NOISE EXPOSURE INFORMATION

Traffic Noise

1. Reduced noise contour maps in Appendix of Policy Document, or
2. Rolled full-scale noise contour maps, and
3. Table 2-1, adjusted as necessary per Table 2-2.

Railroad Noise

1. Reduced noise contour maps in Appendix of Policy Document, or
2. Rolled full-scale noise contour maps, and
3. Table 2-3.

Aircraft Noise

1. Reduced noise contour maps in Appendix of Policy Document, or
2. Rolled full-scale noise contour maps.

Stationary Noise

1. Noise contour maps in Appendix of Policy Document, or
2. Chapters 3.6 & 3.7 of Technical Reference Document.

TABLE 2-1

NOISE CONTOUR DATA
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO L_{dn} CONTOURS

Segment Nos.	Description	Existing 60 dB	Existing 65 dB	Existing 70 dB	Future 60 dB	Future 65 dB	Future 70 dB
STATE HIGHWAYS							
Highway 46							
43-44	Jct. Route 1 to Vineyard Dr.	77	36	16	88	41	19
45-46	Vineyard Dr. to Jct. Route 101	102	47	22	121	56	26
47-48	Jct. Route 101 to Paso Robles Airport Rd.	600	278	129	773	359	167
49-50	Paso Robles Airport Rd. to Jct. Route 41	494	229	106	704	327	152
51-52	Jct. Route 41 to Kern County	331	153	71	471	219	101
Route 101							
71-72	Grand Ave. (SLO) to S. Paso Robles Interchange	861	400	185	1,420	659	306
73-74	S. Paso Robles Intchg. to Jct. Route 46 East	674	313	145	1,156	537	249
75-76	Jct. Route 46 East to South San Miguel Intchg.	669	311	144	981	455	211
COUNTY AREA ROADS							
Salinas River/Adelaida							
131-132	Las Tablas (Route 46 to Bethel Rd.)	75	35	16	86	40	18
133-134	Las Tablas (Bethel Rd. to Hwy 101)	75	35	16	228	106	49
135-136	Las Tablas (east of Hwy 101)	61	28	13	95	44	20
137-138	Main St. (Old County Rd. to Vineyard Dr.)	84	39	18	161	75	35
139-140	Main St. (north of Old County Rd.)	84	39	18	211	98	45
141-142	Nacimiento Lake Dr. (east of Chimney Rock Rd.)	108	50	23	187	87	40

TABLE 2-1 (Continued)

NOISE CONTOUR DATA
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO L_{dn} CONTOURS

Segment Nos.	Description	Existing 60 dB	Existing 65 dB	Existing 70 dB	Future 60 dB	Future 65 dB	Future 70 dB
Paso Robles							
295-296	Creston Rd.	122	56	26	379	176	82
297-298	Niblick-Sherwood-Linne Rds.	97	45	21	260	121	56
299-300	Charolais Rd.	26	12	6	288	134	62
301-302	Spring St.	98	45	21	138	64	30
303-304	Golden Hill Rd.	91	42	20	446	207	96
305-306	Union Rd. (west of Golden Hill Rd.)	34	16	7	107	50	23
307-308	Union Rd. (east of Golden Hill Rd.)	49	23	11	141	65	30
309-310	24th St./Nacimiento Lake Rd.	77	36	17	142	66	31
311-312	South Vine St.	33	15	7	56	26	12
313-314	Airport Rd.	59	27	13	-	-	-

Note: Refer to the "Airport Master Plan and Airport Specific Plan for the Paso Robles Municipal Airport" for future noise contours on Airport Road.

Source: Brown-Buntin Associates, Inc.

TABLE 2-2

ADJUSTMENTS TO TRAFFIC NOISE EXPOSURE FOR TOPOGRAPHY

	Distance from Center of Roadway		
Topographical Situation	**<200′**	**200-400′**	**>400′**
Hillside overlooks roadway	-0-	+1 dB	+3 dB
Roadway is elevated (>15′)	-5 dB	-2 dB	-0-
Roadway in cut/below embankment	-5 dB	-5 dB	-5 dB

TABLE 2-3

DISTANCE (FEET) FROM CENTER OF TRACK TO L_{dn} CONTOURS - SOUTHERN PACIFIC TRANSPORTATION COMPANY SAN LUIS OBISPO COUNTY

	Existing		Future*	
L_{dn} Contour Values	**w/o Horn**	**w/Horn**	**w/o Horn**	**w/Horn**
70 dB	25′	35′	76′	113′
65 dB	53′	76′	163′	244′
60 dB	115′	163′	352′	525′

* Based on a hypothetical operational scenario consisting of 10 freight and 4 passenger trains per day.

Source: Brown-Buntin Associates, Inc.

FIGURE 2-2

PROCEDURE FOR DETERMINING MITIGATION FOR RESIDENTIAL* USES

1. Determine Noise Exposure for site (refer to Figure 2-1 for sources). NOTE: For traffic noise, future contours per Appendix B shall be used.

2. Outdoor Activity Areas: Does the noise level on any portion of the site that is proposed for outdoor activity areas exceed 65 dbA?

   No? - No exterior mitigation required. Interior mitigation may be required, however. Proceed to item #5.

   Yes? - Proceed to item #3.

3. Does the noise level in the outdoor activity areas exceed 70 dBA?

   No? - Proceed to item #4.

   Yes? - Since a barrier wall is expected to achieve only 5 dBA of noise reduction (which is insufficient to reduce noise levels to 65 dBA), an acoustical analysis and recommendations for appropriate mitigation measures, prepared by an expert shall be required. It shall be the responsibility of to the Community Development Director or his/her designee to determine if such analysis is required.

   Exceptions: (1) Where the noise source is aircraft noise and the residential is accessory to an agricultural, commercial, or industrial use, exterior noise reduction is not feasible and mitigation is not required; (2) If the Planning Commission or City Council finds that there is no feasible way to redesign the site (including provision of an open space buffer) to reduce exterior noise levels to 65 dBA or less, up to a maximum of an additional 3 dBA (i.e. up to 68 dBA) may be authorized without need to prepare an acoustical analysis.

4. Is the topographical relationship between the noise source and the outdoor activity area such that a line-of-sight analysis (as described in the Acoustic Design Manual) indicates that a noise barrier placed between the source and the outdoor activity area will effectively shield the outdoor activity area (thereby reducing noise levels to 65 dBA or less)?

   No? - An acoustical analysis prepared by an expert shall be required.

   Yes? - Provide an effective noise barrier as described in the Acoustic Design Manual. Such a barrier may consist of a masonry wall, earthen berm, or non-residential building (e.g. garage). NOTE: The City may require decorative masonry walls between residential uses and noise sources such as arterial streets, highways, railroads and stationary sources.

5. Interior Space: Does the noise level on any portion of the site that is proposed for dwelling units exceed 60 dbA?

   No? - No interior mitigation required. (Compliance with building codes will achieve a noise level reduction of 15 dBA, which would reduce 60 dBA to 45 dBA.)

   Yes? - Proceed to Item #6.

6. Is the required noise level reduction (to achieve 45 dBA interior) more than 30 dBA?

   No? - Provide interior mitigation per Acoustic Design Manual.
   Yes? - An acoustical analysis prepared by an expert shall be required.

*** 5 or more units per site (would include 5 or more condominium units).**

2.4 Community Noise Survey

A community noise survey was conducted in Paso Robles during August 1990 to document background noise levels in areas where noise-sensitive land uses are located. Results of the community noise survey indicate that existing background noise levels in many areas of the city that contain noise-sensitive land uses are relatively quiet.

To preserve quiet conditions, noise level standards and policies are provided in Chapter 3. Chapter 4 describes implementation measures designed to prevent degradation of the existing noise environment as much as possible.

A more detailed discussion of the community noise survey may be found in the Technical Reference Document (Volume II).

3.0 OBJECTIVES AND POLICIES

3.1 Objectives

The objectives of the Noise Element are:

1. To protect the citizens of Paso Robles from the harmful and annoying effects of exposure to excessive noise.

2. To protect the economic base of Paso Robles by preventing incompatible noise-sensitive land uses from encroaching upon existing or planned business areas in which there may be noise-producing uses.

3. To preserve the tranquility of residential areas by preventing the encroachment of noise-producing uses.

4. To educate the residents of Paso Robles concerning the effects of exposure to excessive noise and the methods available for minimizing such exposure.

5. To avoid or reduce noise impacts through site planning and project design, giving second preference to the use of noise barriers and/or structural modifications to buildings containing noise-sensitive land uses.

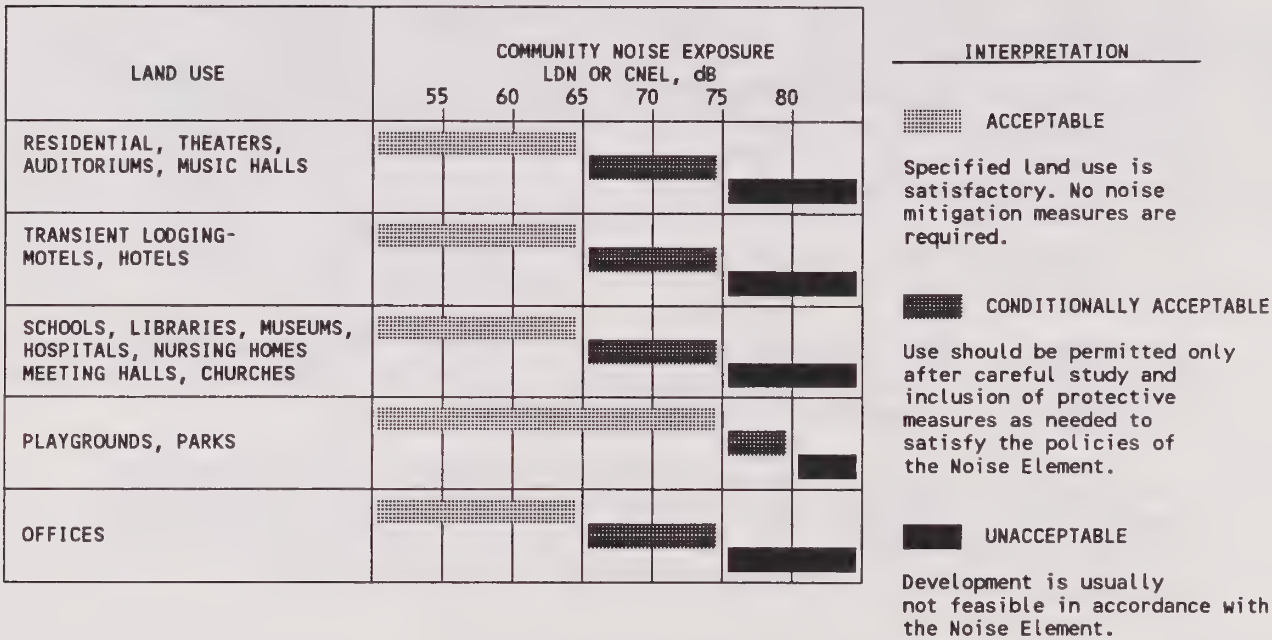
3.2 Land Use Compatibility-Transportation

Figure 3-1 shows the ranges of noise exposure from transportation noise sources which are considered to be acceptable, conditionally acceptable, or unacceptable for the development of different land uses. Figure 3-1 is used to determine whether mitigation is needed for development of land uses near major transportation noise sources. In areas where the noise environment is acceptable, new development may be permitted without requiring noise mitigation. For areas where the noise environment is conditionally acceptable, new development should be allowed only after noise mitigation has been incorporated into the design of the project to reduce noise exposure to the levels specified by the policies listed in Section 3.3. For areas where the noise environment is unacceptable, new development in compliance with the policies of Section 3.3 is usually not appropriate.

The City has selected 65 dBA L_{dn} as the threshold for maximum exterior noise level. This standard was chosen as being generally comparable to the 65 dBA L_{eq} standard, which is used by the California Department of Transportation (CalTrans) and the Federal Highway Administration (FHWA).

FIGURE 3-1

LAND USE COMPATIBILITY FOR NEW DEVELOPMENT NEAR TRANSPORTATION NOISE SOURCES*



* *This figure indicates whether mitigation is required. See Table 3-1 for noise standards.*

3.3 Policies

The following specific policies are adopted by Paso Robles to accomplish the objectives of the Noise Element:

General:

1. The noise standards in this chapter represent maximum acceptable noise levels. New development shall be designed to minimize noise exposure and noise generation in compliance with maximum acceptable noise levels.

Transportation Noise Sources:

2. Within areas impacted by noise from aircraft operations, which includes all land subject to the adopted Airport Land Use Plan, new development of residential uses should be limited as follows:

   a. Subdivision and development may occur in conformance with the Borkey Area Specific Plan for the area east of Buena Vista Road and in conformance with existing R-1,B-3 Zoning on the east side of Prospect Avenue, between Union and Mesa Roads.

   b. In conjunction with the future adoption of the Chandler Ranch Specific Plan, land located north of an imaginary eastward extension of Ardmore Road may be categorized/designated to allow greater density than the present one residential unit per 3 acres provided that the effects of noise from aircraft operations is first considered. (NOTE: This area is not located within the future 65 dB CNEL contour for the Municipal Airport.)

   c. In all other areas within the adopted Airport Land Use Plan, underlying agricultural, commercial, and industrial categorized land should not be recategorized for residential use.

3. Within areas impacted by noise from aircraft operations, which includes all land subject to the adopted Airport Land Use Plan, avigation easements shall be required as a condition of any building permit for new or remodeled residential units.

4. New development of 5 or more residential units per site (threshold for review under the California Environmental Quality Act) should not be permitted in areas exposed to existing or projected future levels of noise from transportation noise sources which exceed 70 dB L_{dn} or CNEL (75 L_{dn}/CNEL for playgrounds and neighborhood parks) unless the project design includes maximum feasible effective mitigation

measures to reduce noise in outdoor activity areas and interior spaces to or below the levels specified for the given land use in Table 3-1.

5. To reduce noise from vehicular sources, wherever feasible, the City should improve road surfaces, reduce speed limits, prohibit large truck traffic, reduce traffic volumes and enforce regulations.

Stationary Noise Sources:

6. New development of 5 or more residential units per site should not be permitted where the noise level due to existing stationary noise sources will exceed the noise level standards of Table 3-2 unless maximum feasible effective noise mitigation measures have been incorporated into the design of the development to reduce noise exposure to or below the levels specified in Table 3-2.

7. Noise created by new proposed stationary noise sources or existing stationary noise sources which undergo modifications that may increase noise levels should be mitigated so as not to exceed the noise level standards of Table 3-2 on lands designated for noise-sensitive uses. This policy does not apply to noise levels associated with agricultural operations.

TABLE 3-1

MAXIMUM ALLOWABLE NOISE EXPOSURE-TRANSPORTATION NOISE SOURCES

	Outdoor Activity Areas[1]	Interior Spaces	
Land Use	L_{dn}/CNEL, dB	L_{dn}/CNEL, dB	L_{eq}, dB[2]
Residential	65 [3]	45	--
Hotels, motels	65 [3]	45	--
Hospitals, Nursing Homes	65 [3]	45	--
Theaters, Auditoriums, Meeting Halls, Office Buildings, Schools, Libraries	65 [3]	--	45
Playgrounds, Parks	75	--	--

[1] Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.

[2] As determined for a typical worst-case hour during periods of use.

[3] Where it is not possible to reduce noise in outdoor activity areas to 65 dB L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 68 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

TABLE 3-2

MAXIMUM ALLOWABLE NOISE EXPOSURE-STATIONARY NOISE SOURCES[1]

	Daytime (7 a.m. to 10 p.m.)	**Nighttime (10 p.m. to 7 a.m.)**
Hourly L_{eq}, dB[2]	50	45
Maximum level, dB[2]	70	65
Maximum level, dB-Impulsive Noise[3]	65	60

[1] As determined at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property line noise mitigation measures.

[2] Sound level measurements shall be made with slow meter response.

[3] Sound level measurements shall be made with fast meter response.

NOTE: "Slow" and "fast" meter reponses are switch settings on noise meters. The slow setting dampens impulsive fluctuations to give an average noise level; the fast setting allows recordation of impulsive noises.

4.0 IMPLEMENTATION MEASURES

To achieve compliance with the policies of the Noise Element, Paso Robles undertakes the following implementation program, which focuses on the prevention of new noise-related land use conflicts by requiring that new development be reviewed to determine whether it complies with the policies in Chapter 3. If mitigation of noise impacts is necessary it shall be achieved by

a. Implementing the standard noise mitigation packages contained in the Acoustical Design Manual (Volume III) where conditions referred to in Measures 4.3 and 4.4, below, are met.

b. Implementing mitigation measures identified in an acoustical analysis meeting the requirements of Table 4-1.

The noise exposure maps in this document and the information concerning the effects of noise on people and techniques available for noise control in the Technical Reference Document (Volume II) and Acoustical Design Manual are used in reviewing the noise affects of new development. The Acoustical Design Manual (Volume III) describes standard noise mitigation packages which may be used to reduce noise exposure inside buildings and within outdoor activity areas by specified amounts.

The noise exposure maps are intended as a screening device to determine when a proposed development may be exposed to excessive noise levels which require mitigation and to provide guidance in the long range planning processes. Generally, the noise exposure maps provide a conservative (worst-case) assessment of noise exposure for the major noise sources identified for study. It is probable that other major sources, especially stationary sources, of noise will be identified during the project review process, since only a representative sample of such sources was evaluated during the preparation of this document.

The Technical Reference Document and Acoustical Design Manual should be used to guide determinations of whether or not proposed noise mitigation measures are a reasonable and effective application of the techniques available, and likely to achieve the desired results. Control of noise at the source, and through the thoughtful location and orientation of receiving uses, should be given preference over the control of noise along the path of transmission through the use of noise barriers or the acoustical treatment of buildings.

4.1 The City shall review new public and private development proposals to determine conformance with the policies of this Noise Element.

4.2 When mitigation must be applied to satisfy the policies in Chapter 3.3, the following priorities for mitigation shall be observed, where feasible:

First: Use of setbacks and/or open space separation;

Second: Site layout/orientation/shielding of noise-sensitive uses with non-noise-sensitive uses;

Third: Structural measures: acoustical treatment of buildings and noise barriers constructed of concrete, wood or materials other than earth;

Fourth: Construction of earthen berms.

4.3 a. For new development of five (5) or more residential units per site (including 5 or more condominiums), mitigation shall proceed as described in Figure 2-2. Where an acoustical analysis prepared by a noise expert is called for, the report of said analysis should be submitted prior to approval of a subdivision map, parcel map, conditional use permit, or development plan for apartments, so that decision makers can determine if Noise Element polices and standards are being properly implemented.

b. For new development of two (2) to four (4) residential units per site, where outdoor activity areas of a site are impacted with noise exceeding 65 dbA, the Development Review Committee may require installation of effective noise barriers.

c. For new development of four (4) or less residential units per site, where mitigation measures are necessary to reduce interior noise levels to 45 dBA, the Building Official shall require incorporation of those measures listed in the Acoustic Design Manual (Volume III) for the appropriate amount of noise reduction.

4.4 For non-residential noise-sensitive uses, mitigation may proceed in a manner similar to that described in Figure 2-2. Where an acoustical analysis prepared by a noise expert is called for, the report of said analysis should be submitted prior to approval of a subdivision map, parcel map, conditional use permit, or development plan so that decision makers can determine if Noise Element polices and standards are being properly implemented.

4.5 If the Community Development Director or his/her designee determines, from substantial evidence based on analysis, that a proposed new noise-sensitive land use may be exposed to noise levels that exceed the standards in Section 3.3, notwithstanding the noise contour information in this Noise Element, an acoustical analysis meeting the requirements in Table 4-1 may be required.

4.6 The City should update its noise ordinances to be consistent with the Noise Element's objectives, policies, and standards.

4.7 Where a new stationary noise source is proposed to be developed or an existing stationary noise source is proposed to be expanded, mitigation of noise levels that exceed those listed in Table 3-2 shall be required.

4.8 Where mitigation of noise levels in accordance with the policies and standards of this Noise Element is not feasible, the City Council may reduce or waive the applicable policies and standards to the degree needed to allow reasonable use of the property, provided that noise levels are mitigated to the maximum extent feasible.

4.9 The City shall develop and employ procedures to ensure that noise mitigation measures required pursuant to an acoustical analysis or as specified in the Noise Element are implemented in the development review and building permit processes.

4.10 The City will enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC).

4.11 The City will periodically review and update the Noise Element to ensure that noise exposure information and specific policies are consistent with changing conditions within the City and with noise control regulations or policies enacted after the adoption of this element.

4.12 The City shall make the Acoustical Design Manual available to the public so that they can incorporate noise reduction measures into private projects consistent with the goals and policies of this Noise Element.

TABLE 4-1

REQUIREMENTS FOR AN ACOUSTICAL ANALYSIS

An acoustical analysis prepared pursuant to the Noise Element shall:

1. Be the financial responsibility of the applicant.

2. Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.

3. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions. Where actual field measurements cannot be conducted, all sources of information used for calculation purposes shall be fully described. When the use being studied is a commercial or industrial use, all noise sources related to the operation, service and maintenance of the facility shall be considered, including but not limited to the following: parking lot and landscape maintenance; refuse collection; truck loading/unloading activities; amplified sound; and outdoor sales and activities.

4. Estimate existing and projected (20 years) noise levels in terms of the descriptors used in Tables 3-1 and 3-2, and compare those levels to the adopted policies of the Noise Element. Projected future noise levels shall take into account noise from planned streets, highways and road connections.

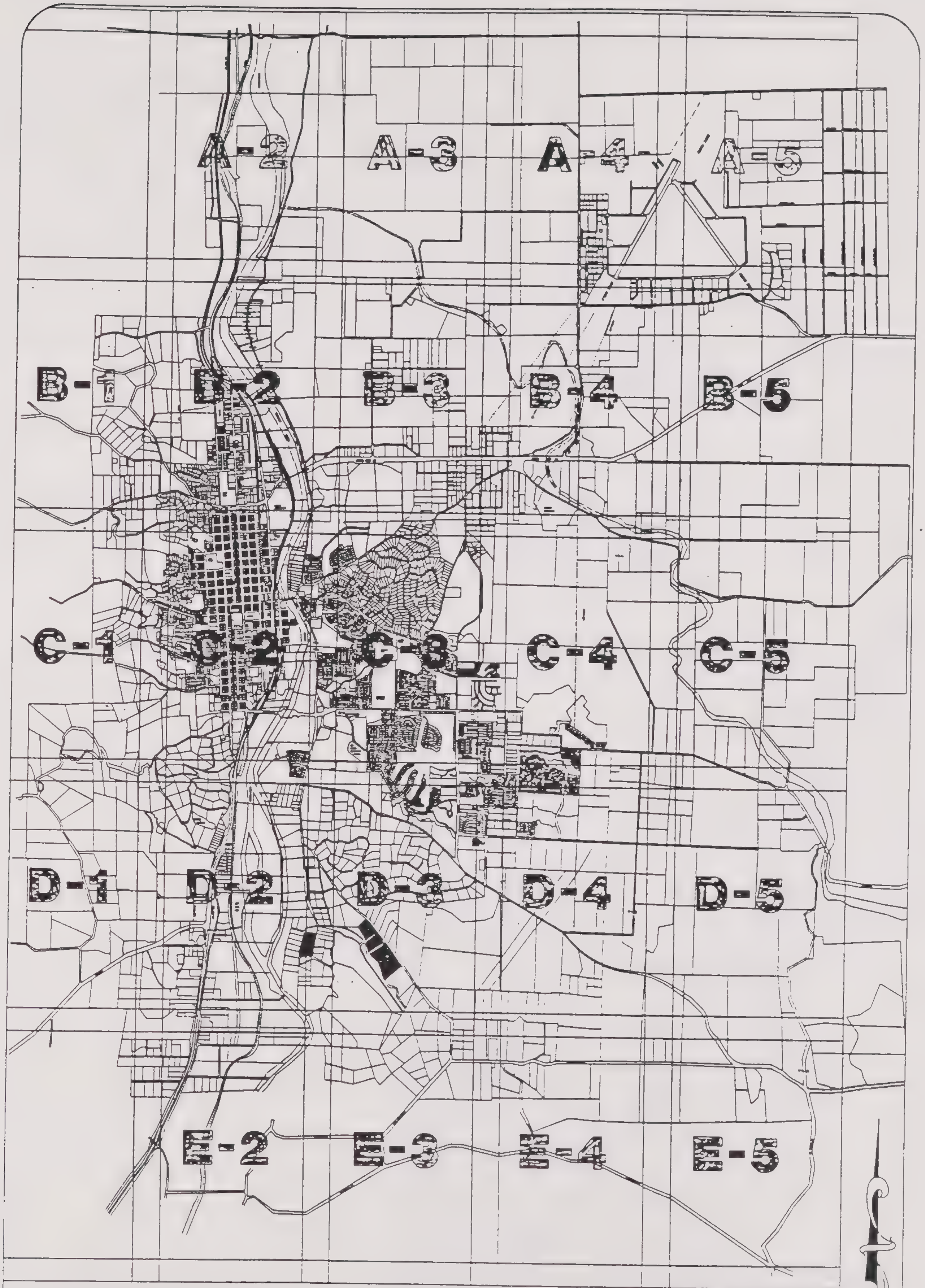
5. Recommend appropriate mitigation to meet or exceed the policies and standards of the Noise Element, giving preference to proper site planning and design over mitigation measures which require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive land uses.

6. Estimate noise exposure after the prescribed mitigation measures have been implemented.

APPENDIX A

NOISE CONTOUR MAPS (1990)

BBA

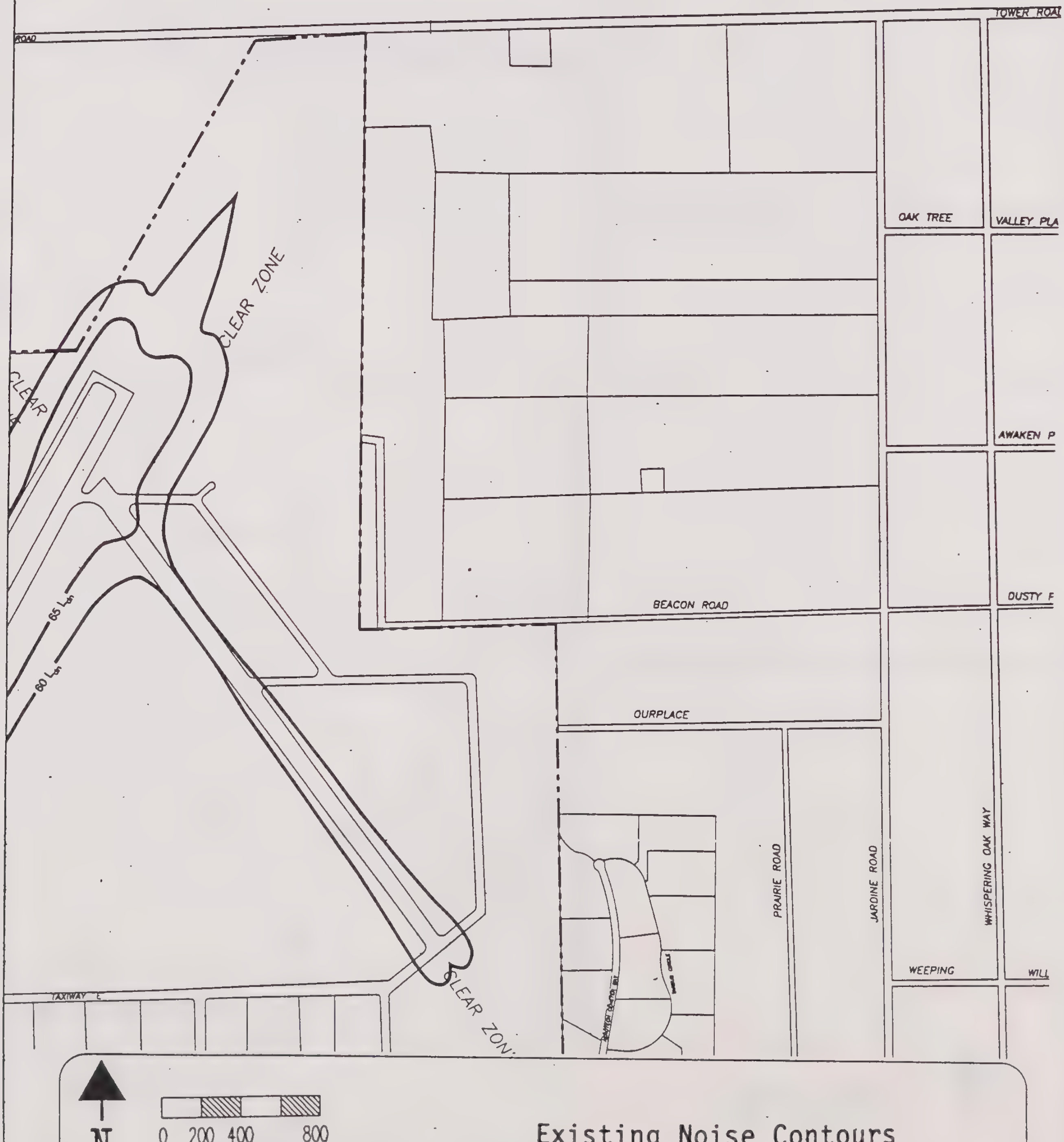


CITY OF EL PASO DE ROBLES
ATLAS INDEX MAP

N

0 200 400 800
(Feet)

Existing Noise Contours



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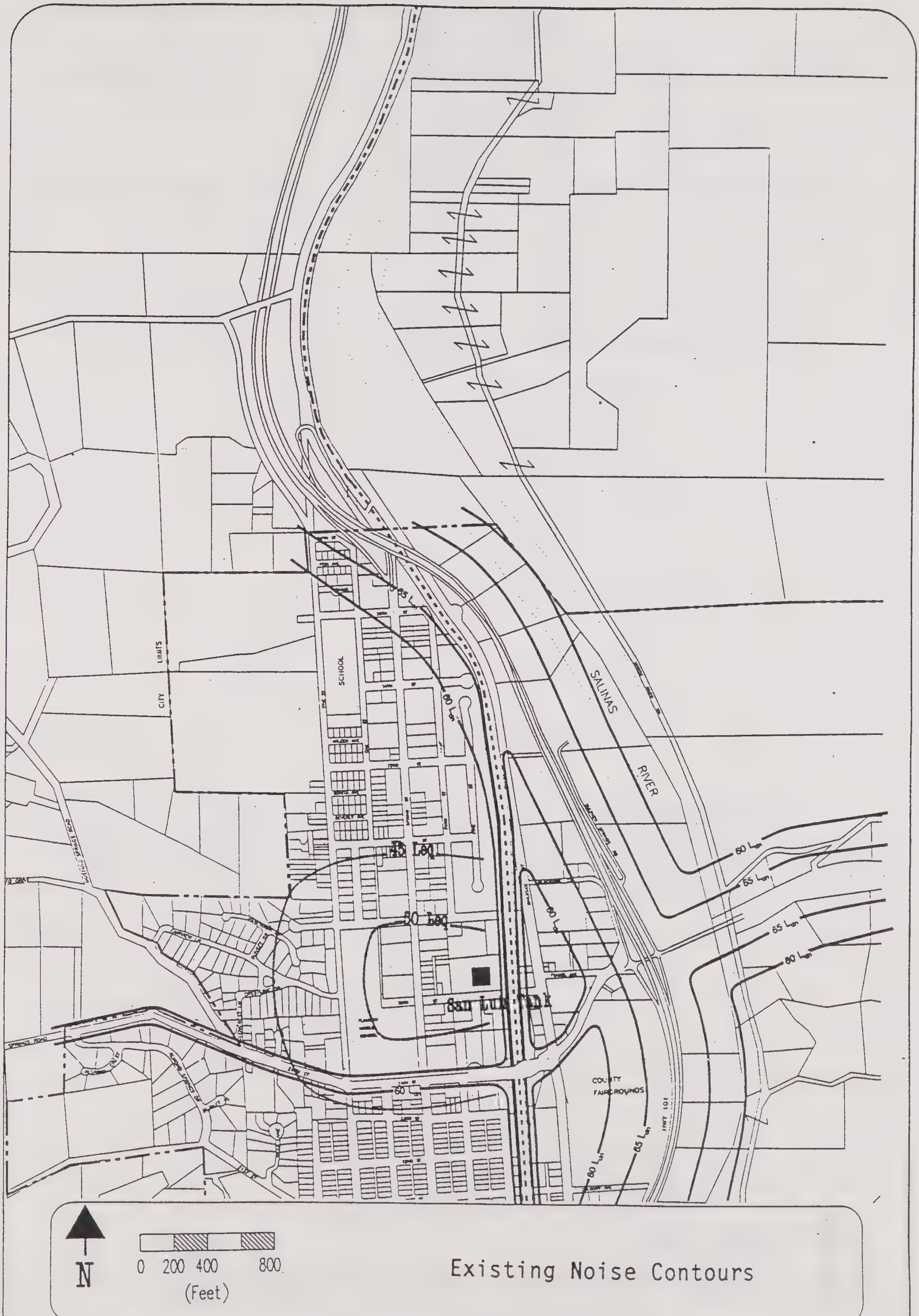

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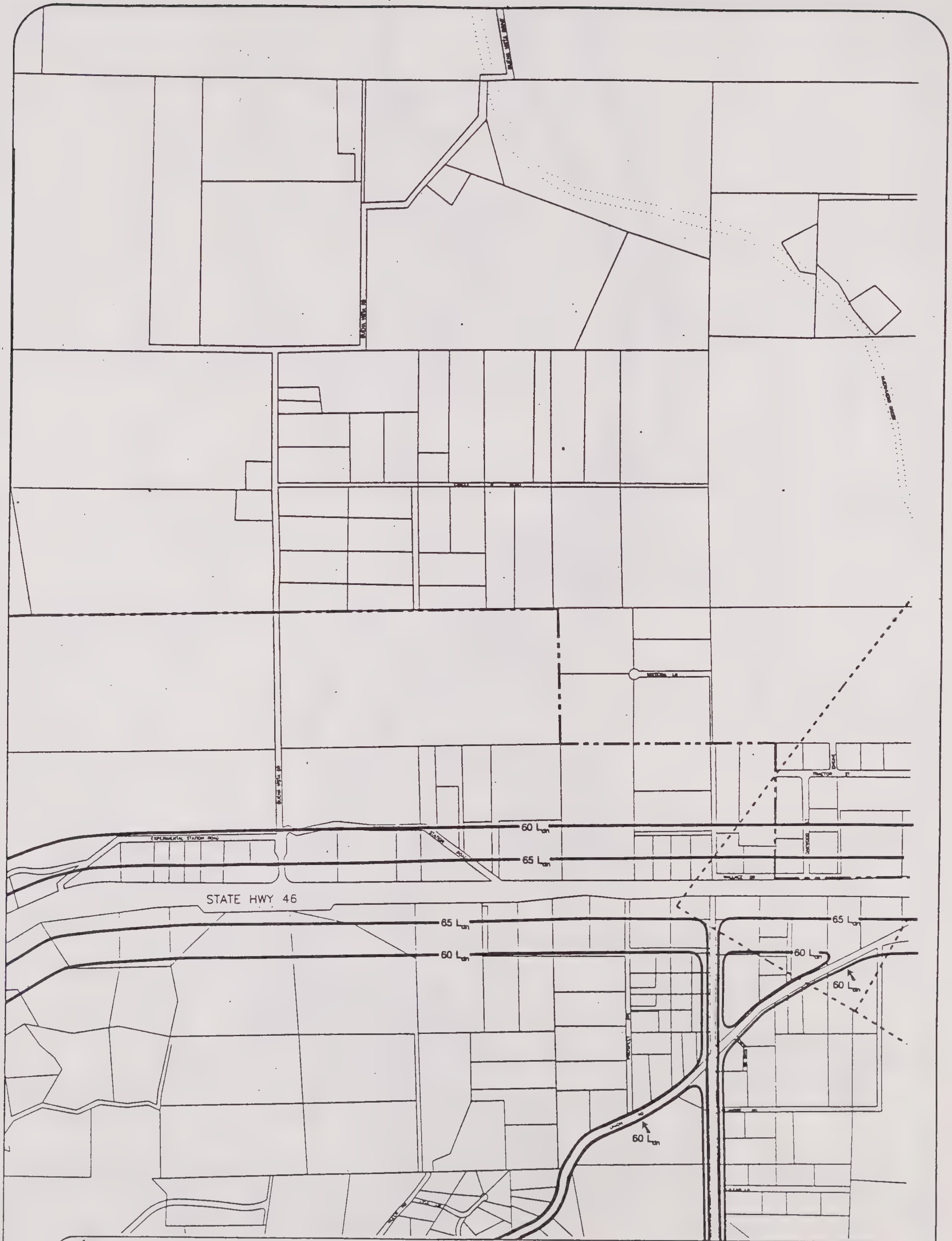
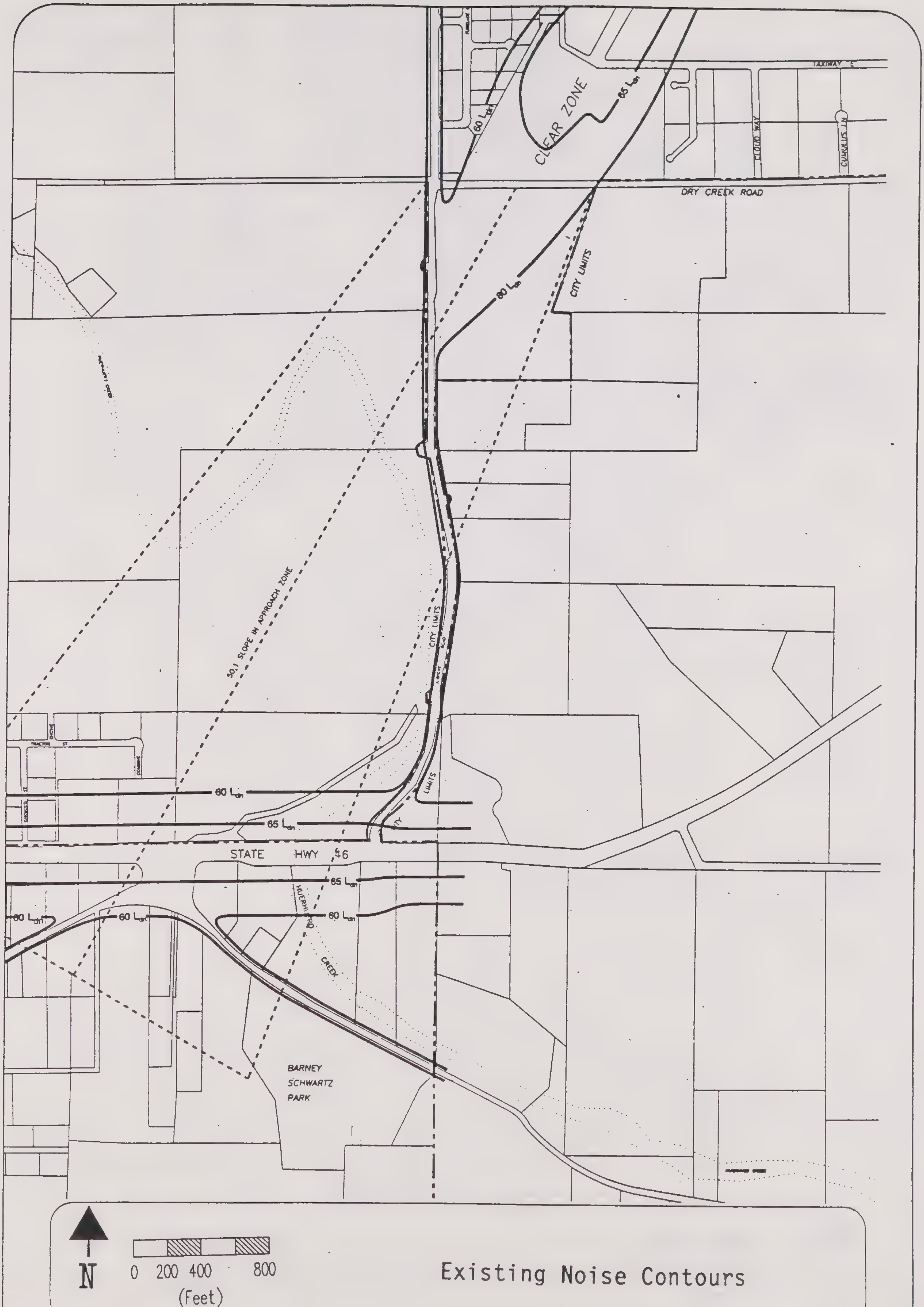


Existing Noise Contours

B-3



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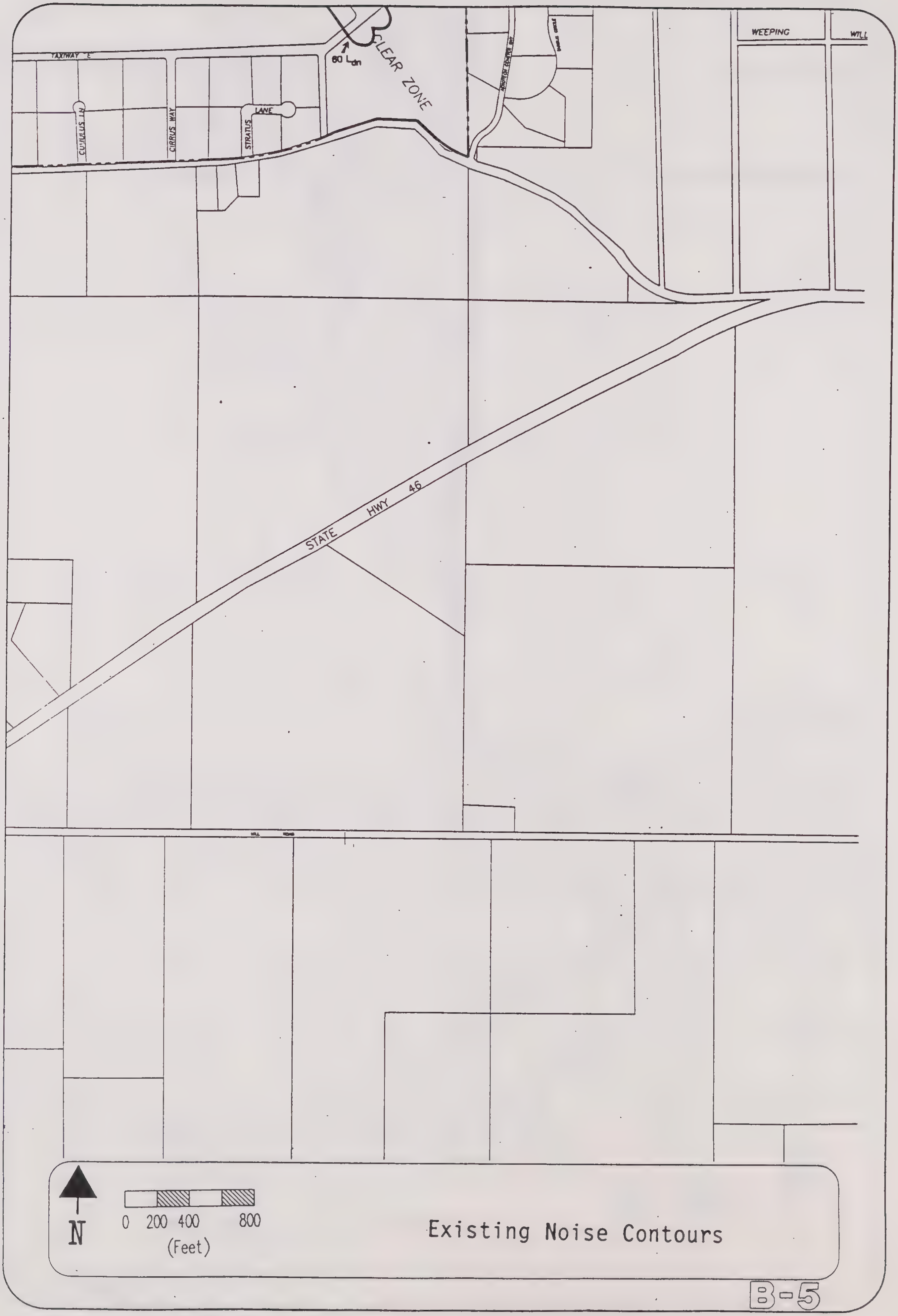
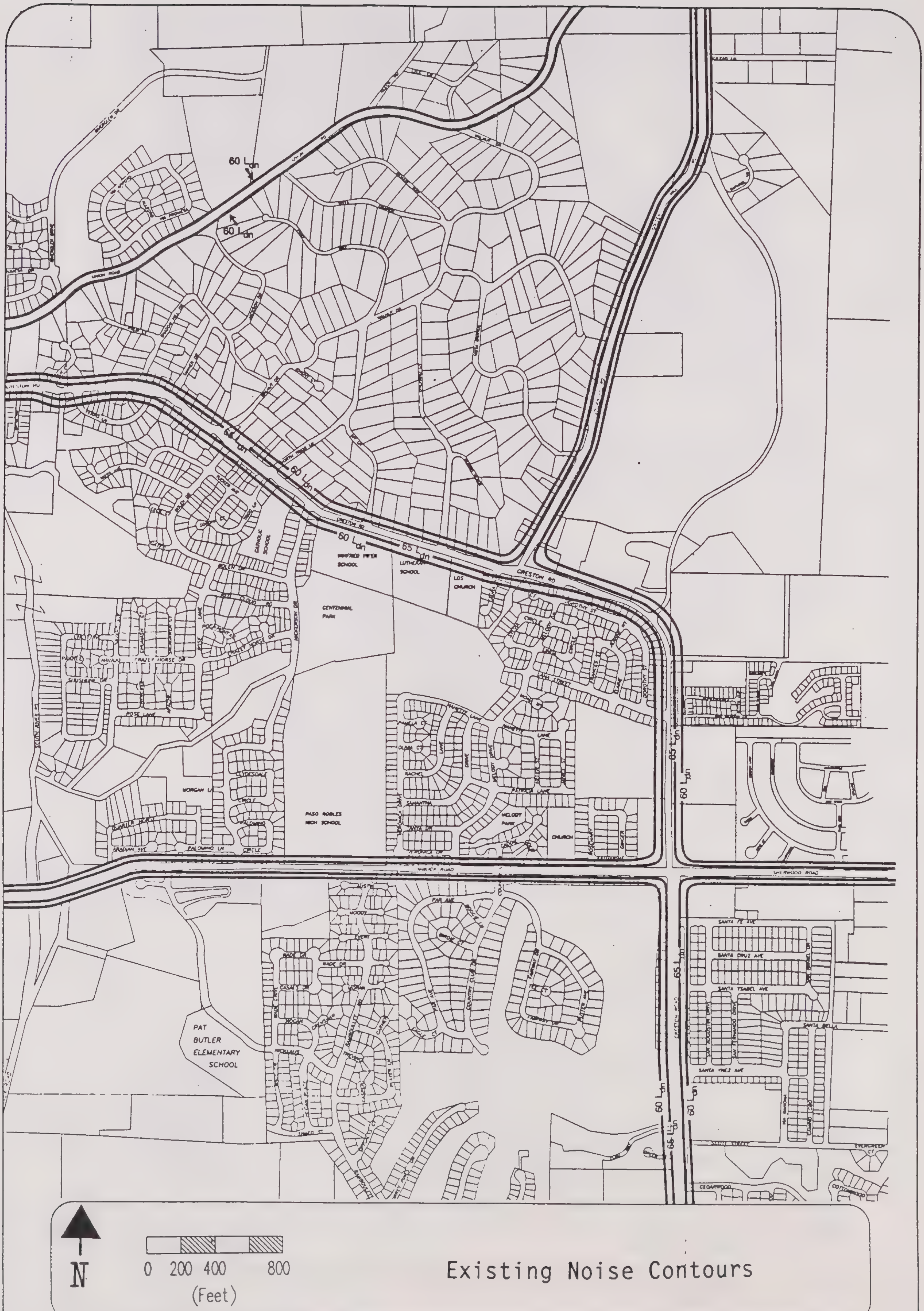

TAXIWAY E
CUMULUS LN
CIRRUS WAY
STRATUS
LANE
60 Ldn
CLEAR ZONE
WEEPING
WILL
STATE HWY 46
N
0 200 400 800
(Feet)
Existing Noise Contours
B-5

N

0 200 400 800

(Feet)

Existing Noise Contours



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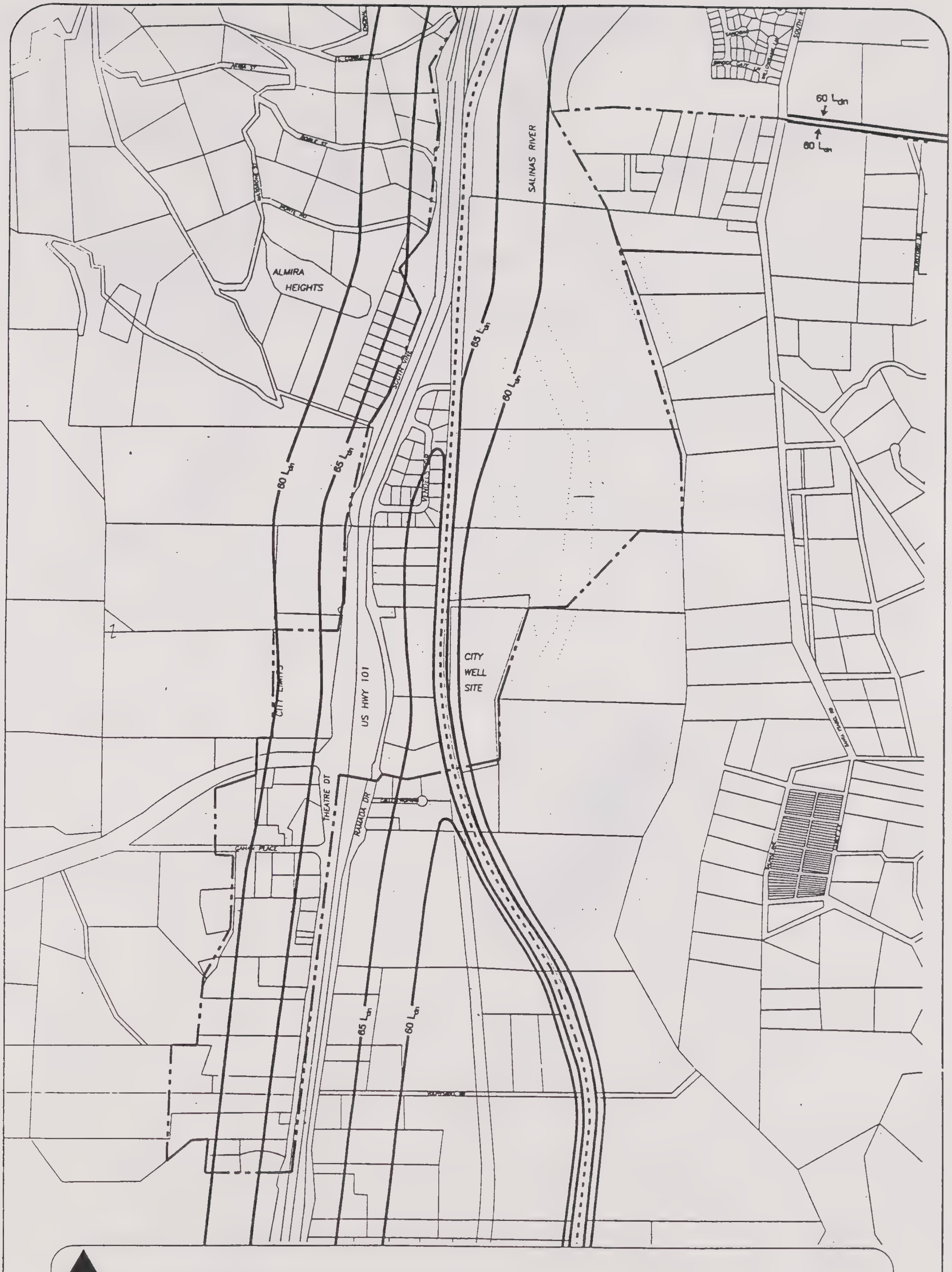


Existing Noise Contours

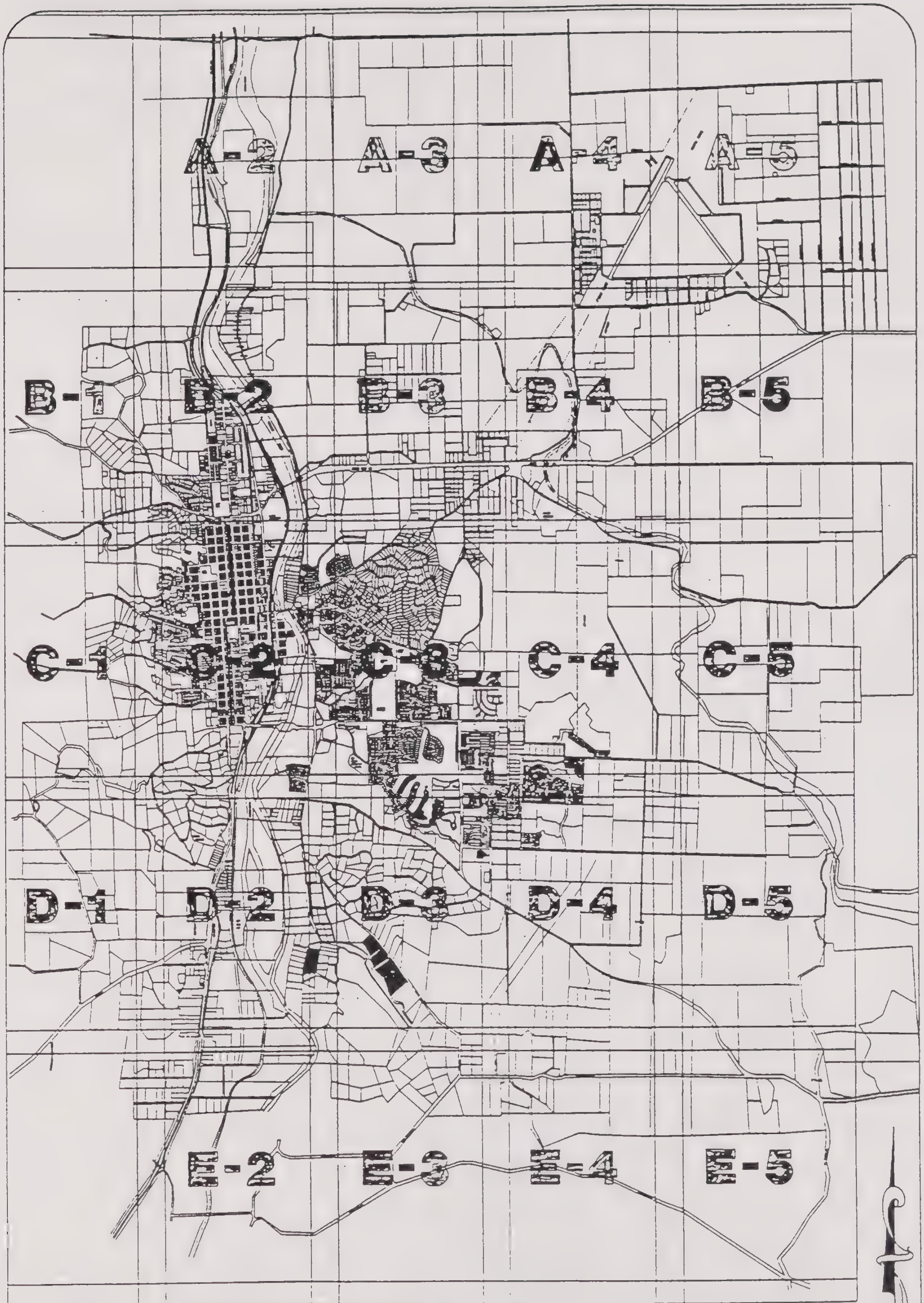
D-2

Existing Noise Contours

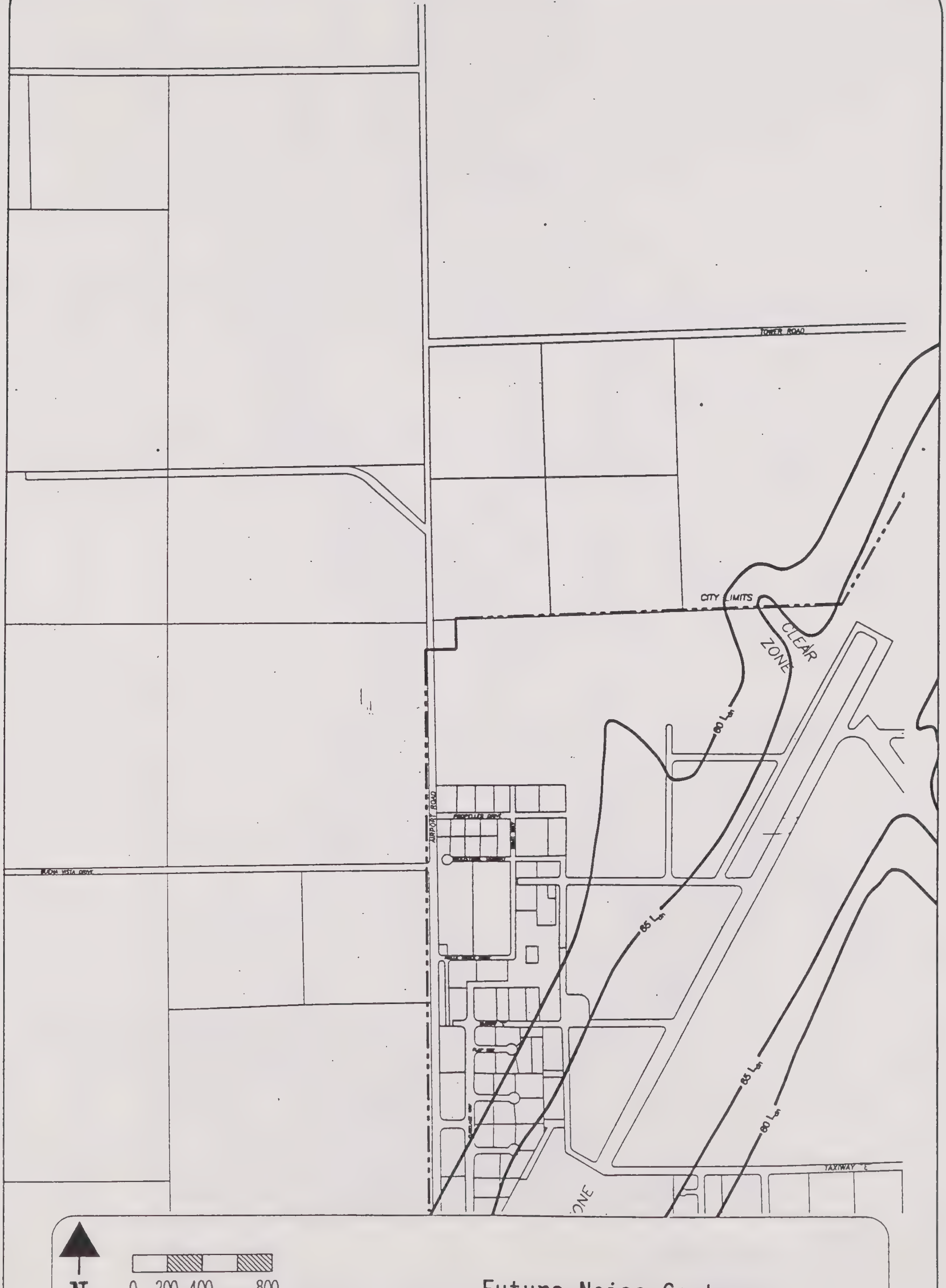
APPENDIX B

NOISE CONTOUR MAPS (BUILDOUT)

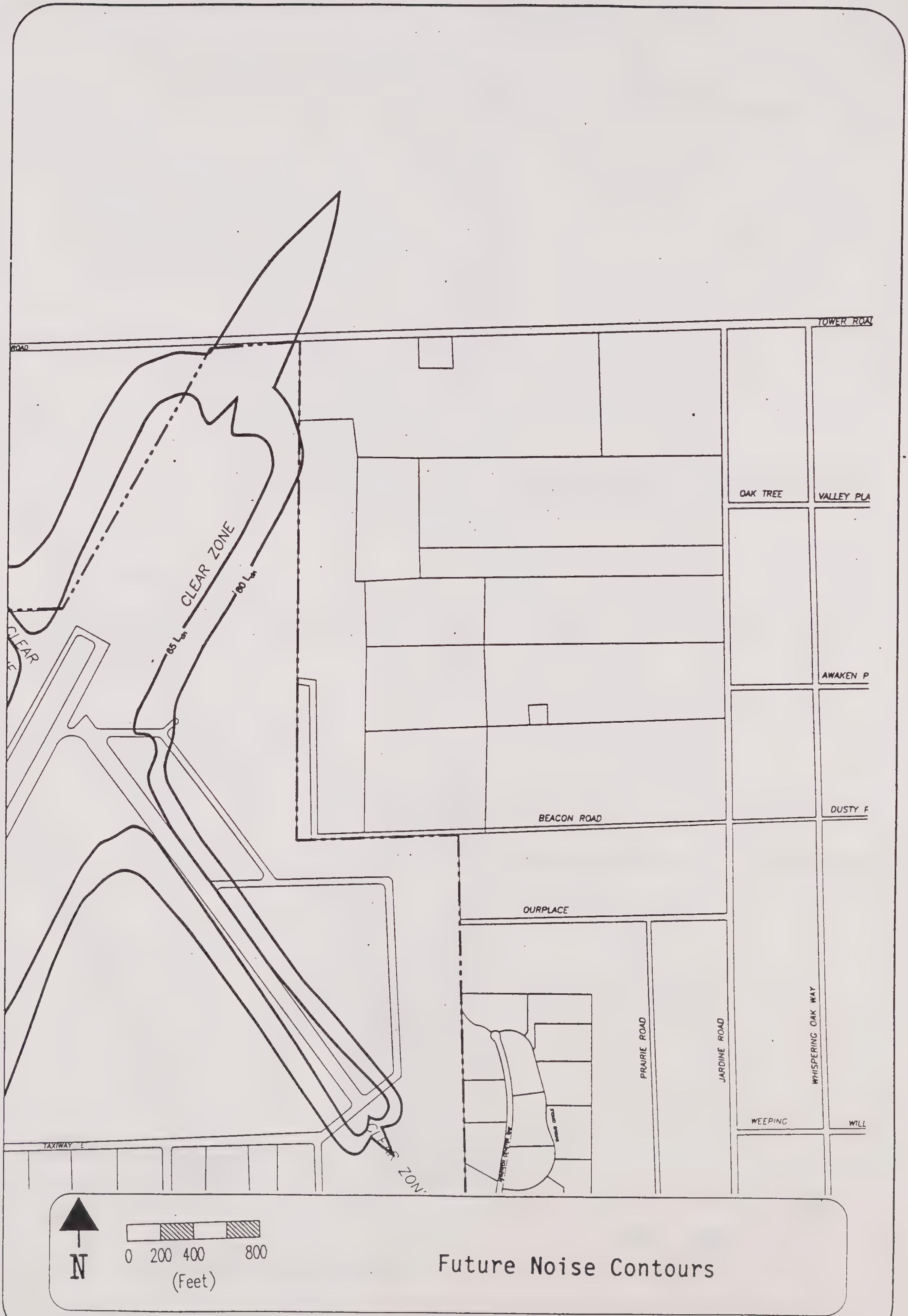
BBA



CITY OF EL PASO DE ROBLES
ATLAS INDEX MAP



Future Noise Contours



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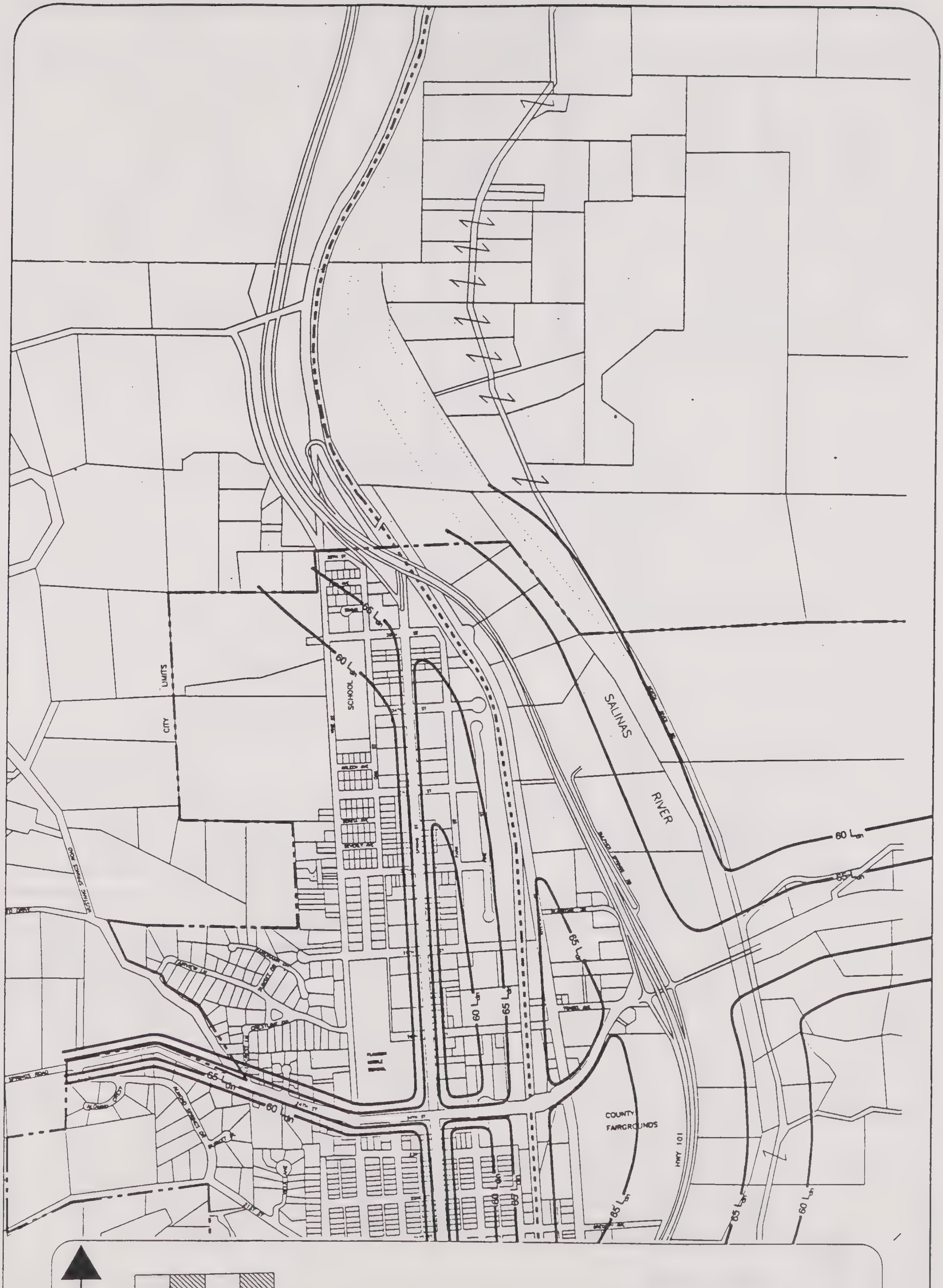

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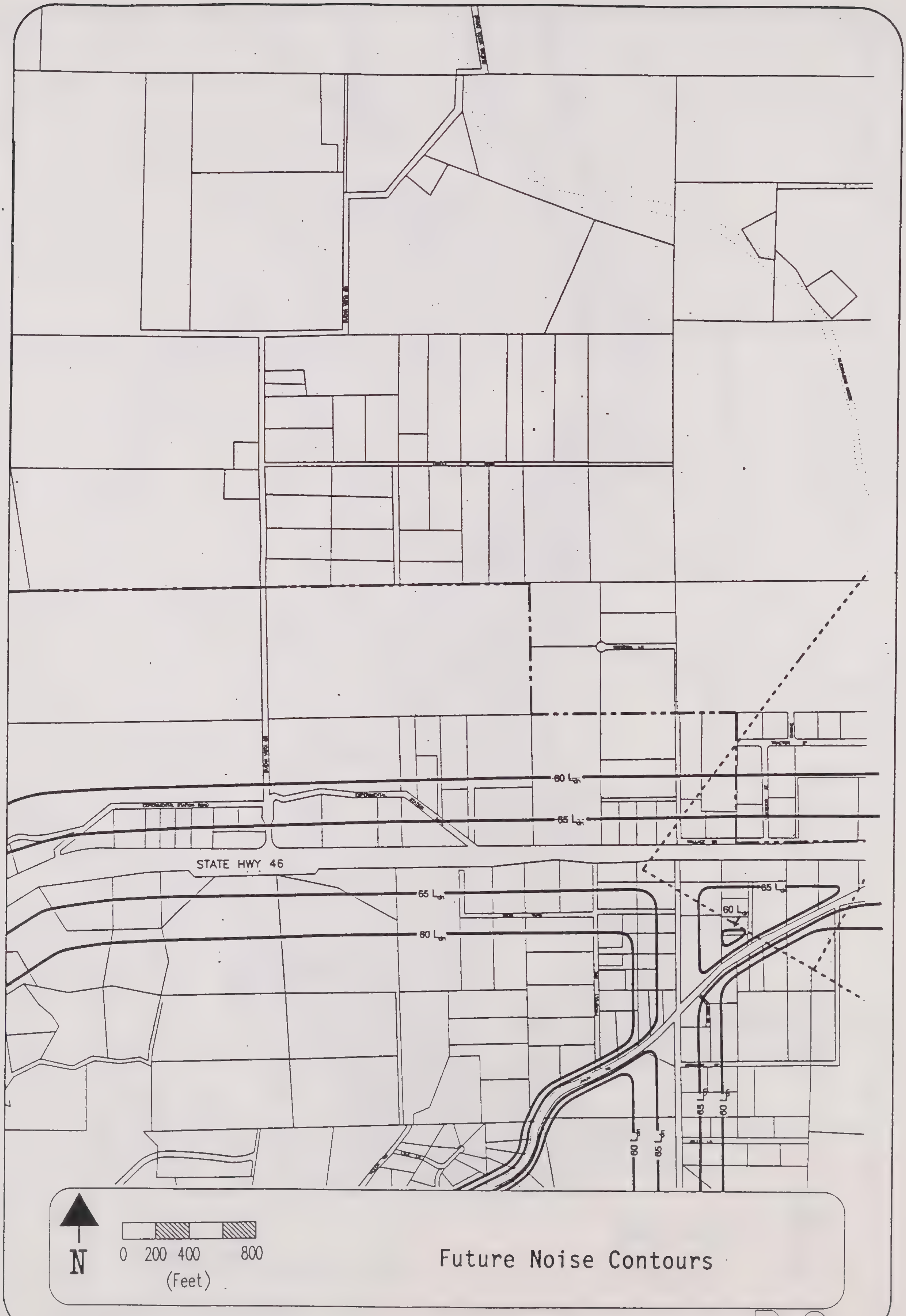

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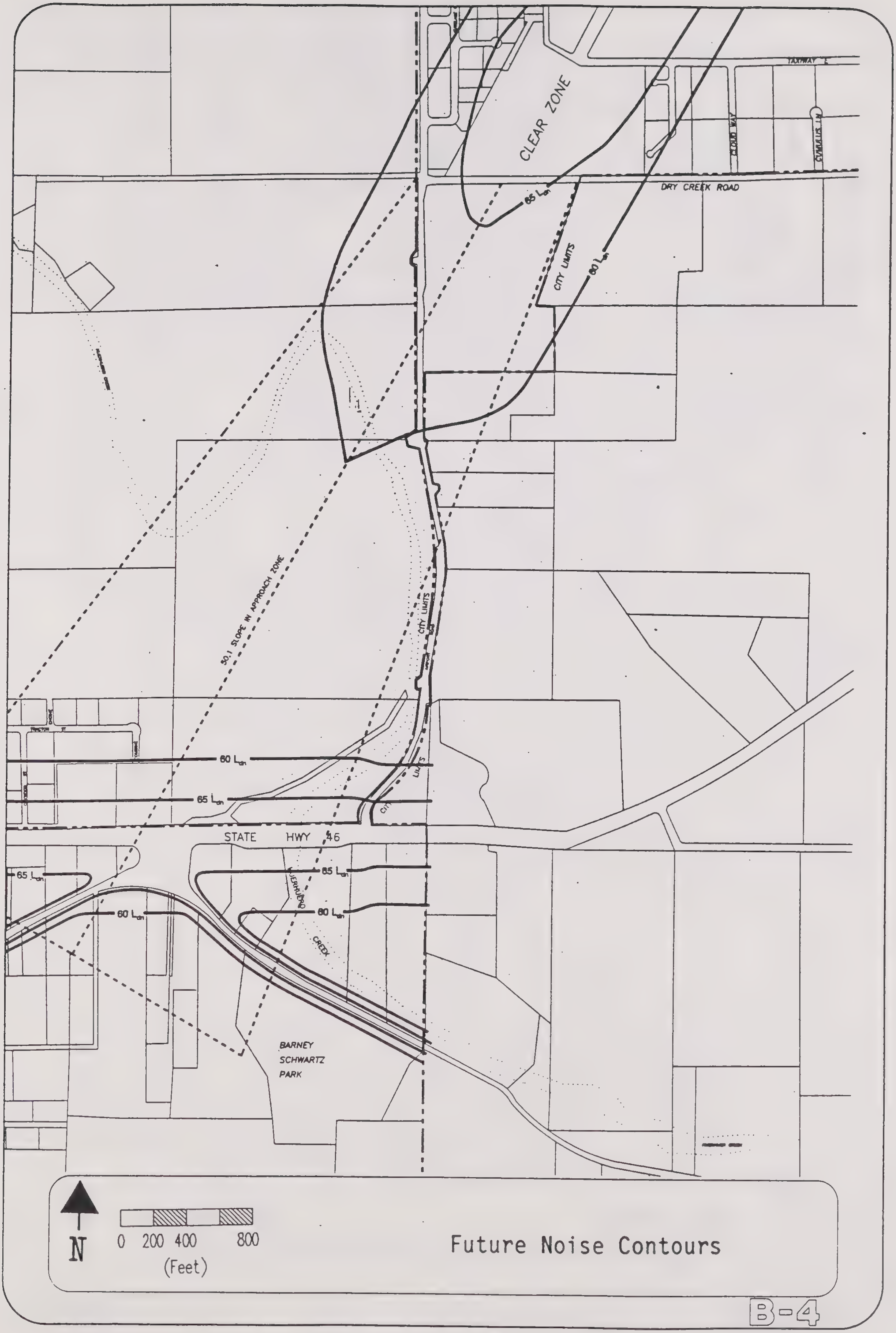
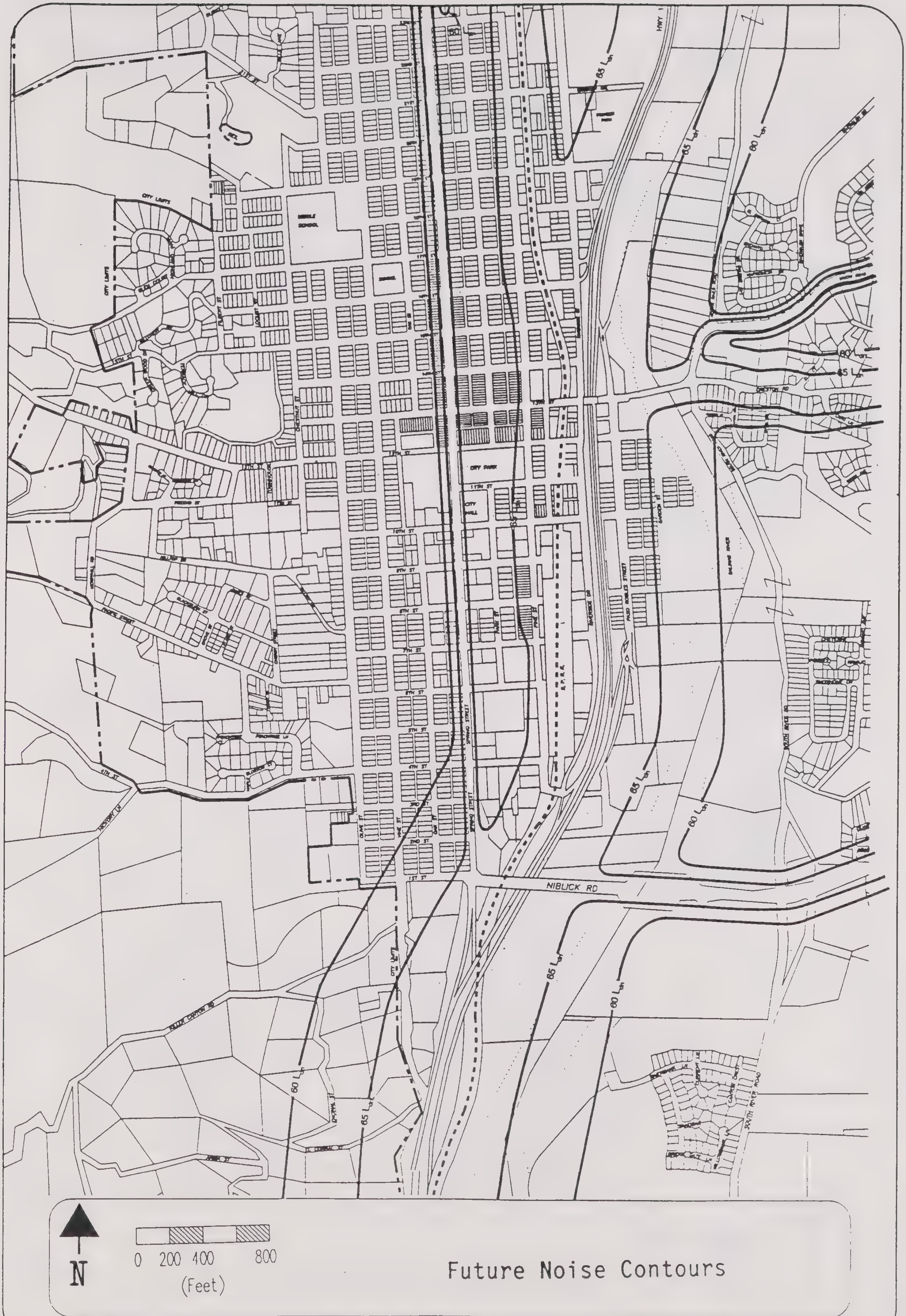


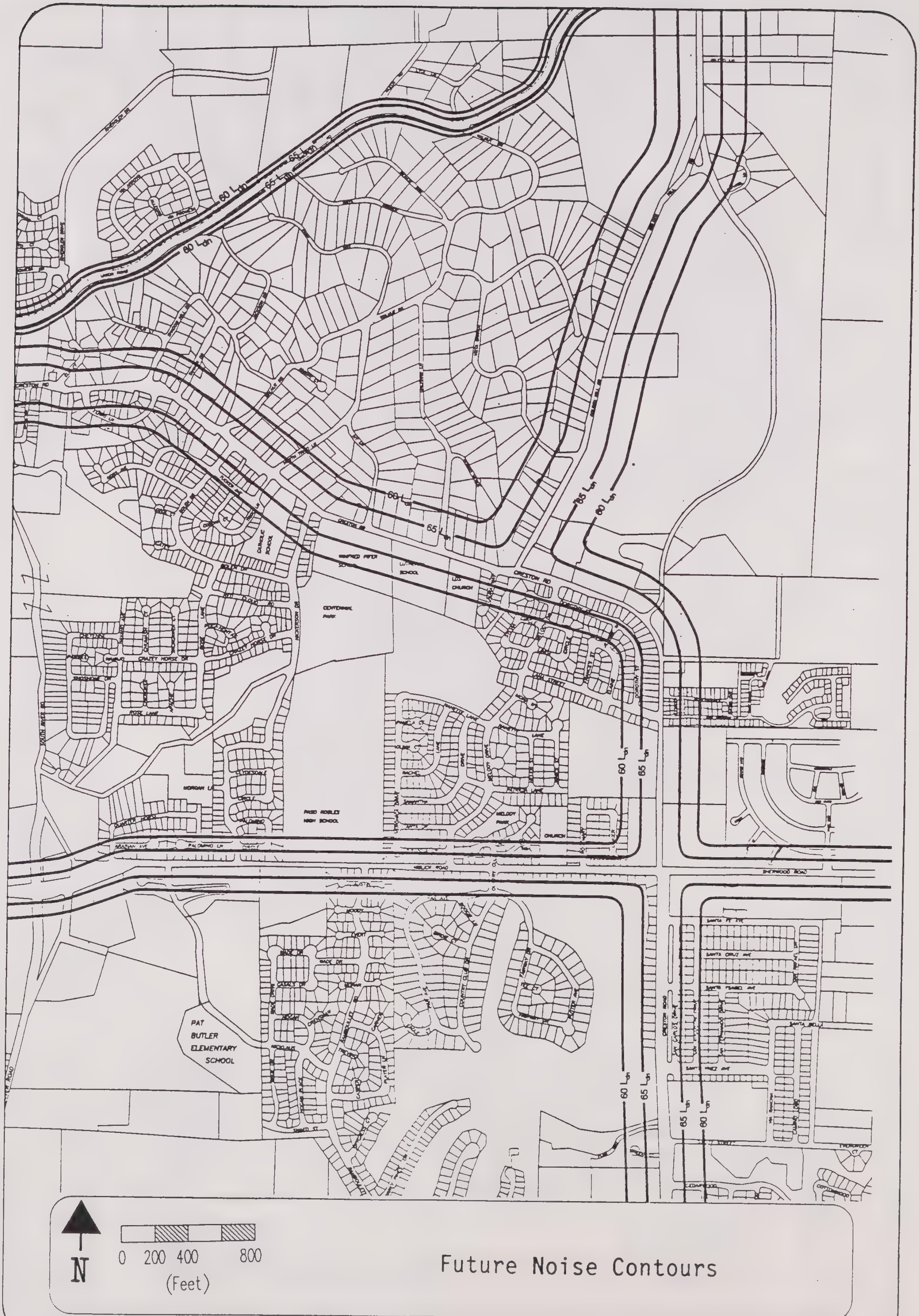
Future Noise Contours

B-4

Future Noise Contours



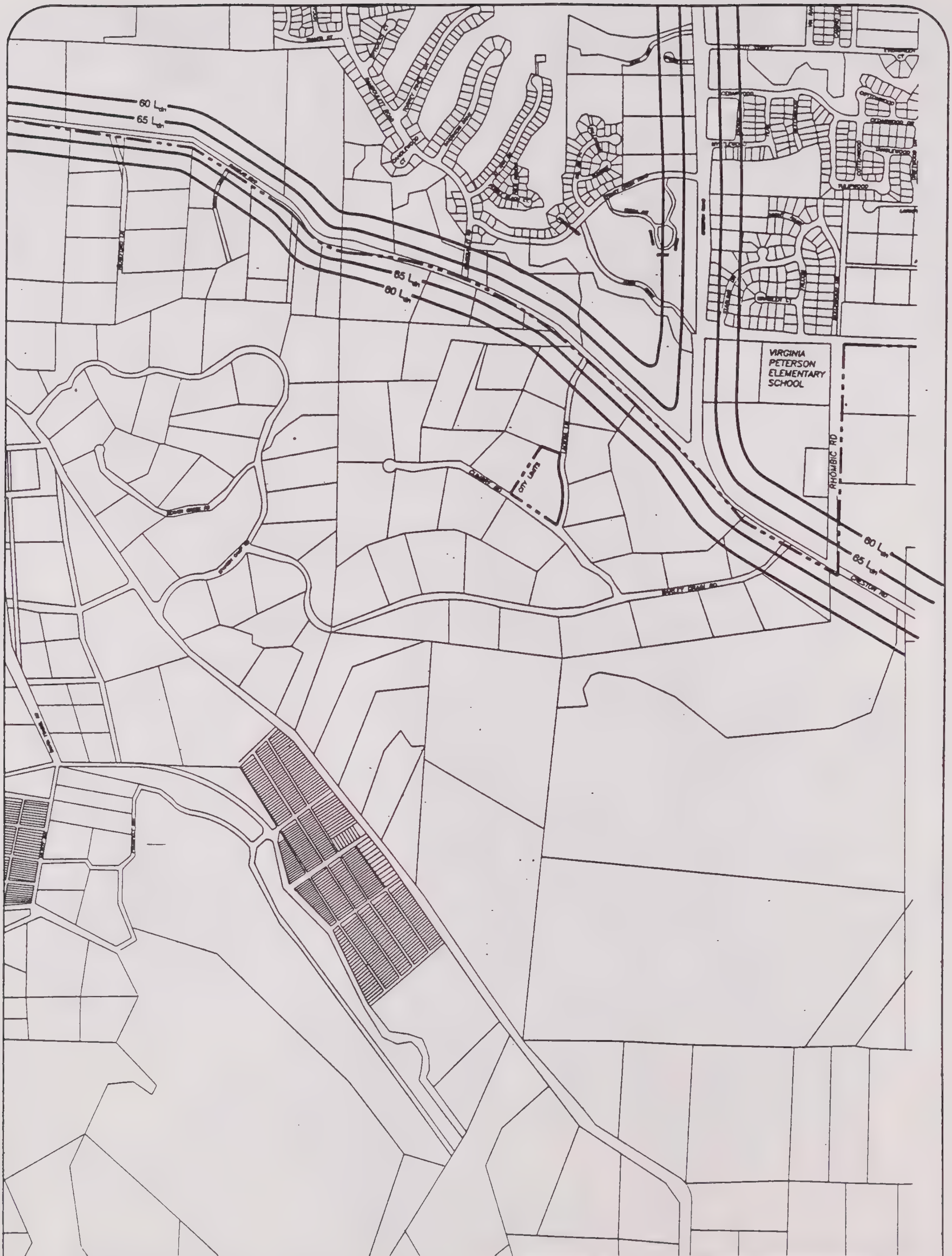
Future Noise Contours



Future Noise Contours

ALMIRA HEIGHTS
SOUTH VINE
VENDELS CIR
SALINAS RIVER
CITY WELL SITE
CITY LIMITS
US HWY 101
THEATRE DT
RAMADA DR
60 L_{dn}
65 L_{dn}
N
0 200 400 800
(Feet)
Future Noise Contours

D-2



N

0 200 400 800
(Feet)

Future Noise Contours

D-3

NOISE ELEMENT
OF THE
GENERAL PLAN
OF THE
CITY OF EL PASO DE ROBLES

VOLUME II - TECHNICAL REFERENCE DOCUMENT

APRIL, 1994

NOISE ELEMENT OF THE GENERAL PLAN
CITY OF EL PASO DE ROBLES, CALIFORNIA

VOLUME II - TECHNICAL REFERENCE DOCUMENT

APRIL, 1994

PREPARED FOR

SAN LUIS OBISPO COUNTY AND THE CITIES OF ARROYO GRANDE, ATASCADERO, GROVER CITY, MORRO BAY, PASO ROBLES, PISMO BEACH AND SAN LUIS OBISPO

(Edited from a document prepared in September, 1991 by Brown-Buntin Associates, Inc, to contain only that information pertaining to Paso Robles and its surroundings)

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TECHNICAL REFERENCE DOCUMENT-NOISE ELEMENT, VOLUME II

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1.0 INTRODUCTION

This Technical Reference Document is adopted as part of the Noise Element of the General Plan. It provides background information on the data and methods used to prepare noise exposure information for major noise sources within the City of Paso Robles and its Planning Impact Area, as defined by the Land Use Element of the General Plan in compliance with the Government Code. Information concerning the measurement and effects of noise on the community is also included in this document. The Technical Reference Document should be used as a resource when evaluating the noise-related implications of specific development proposals or long-range planning efforts.

NOTE: The original Technical Reference Document was prepared by Brown-Buntin Associates for the County of San Luis Obispo, as a whole, including all of its incorporated cities. This Technical Reference Document, for the City of Paso Robles, has been edited to contain only that information pertinent to the City.

2.0 NOISE AND ITS EFFECTS ON PEOPLE

2.1 Fundamentals of Noise Assessment:

Noise is often defined simply as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon. The descriptors of community noise in current use are the results of many years of effort to translate objective measurements of sound into measures of subjective reaction to noise. Before elaborating on these descriptors, it is useful to discuss some fundamental concepts of sound.

Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, now called Hertz (Hz) by international agreement.

The speed of sound in air is approximately 770 miles per hour, or 1,130 feet/second. Knowing the speed and frequency of a sound, one may calculate its wavelength, the physical distance in air from one compression of the atmosphere to the next. An understanding of wavelength is useful in evaluating the effectiveness of physical noise control devices such as mufflers or barriers, which depend upon either absorbing or blocking sound waves to reduce sound levels.

To measure sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel (dB) scale was devised.

The decibel scale uses the hearing threshold as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. Use of the decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. In the range of usual environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighting the frequency response of a sound level measurement device (called a sound level meter) by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. Figure 2-1 illustrates typical A-weighted sound levels due to recognizable sources.

It is common to describe community noise in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), which is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptors such as L_{dn} and CNEL, and shows very good correlation with community response to noise.

Examples of Noise Levels

Level, dBA	Activity	Subjective Evaluations
140		
	Sonic booms	
130	Threshold of pain	
		Deafening
120	Threshold of discomfort	
	Amplified music	
110	Commercial jet takeoff at 200 feet	
100	Auto horn at 10 feet	
		Very loud
90	Noisy factory interior	
	Heavy truck at 50 feet	
80		
	New automobile at 50 feet	
		Loud
70	Stenographic room	
60	Normal conversation at 6 feet	
50	Office interior	Moderate
40	Soft radio music	
30	Residence interior	Faint
20	Whisper at 6 feet	
10		
	Human breathing	Very faint
0	Threshold of audibility	

BBA

Two composite noise descriptors are in common use today: L_{dn} and CNEL. The L_{dn} (day-night average level) is based upon the average hourly L_{eq} over a 24-hour day, with a +10 decibel weighting applied to nighttime (10:00 p.m. to 7:00 a.m.) L_{eq} values. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were subjectively twice as loud as daytime exposures. The CNEL (Community Noise Equivalent Level), like L_{dn}, is also based upon the weighted average hourly L_{eq} over a 24-hour day, except that an additional 4.77 decibel penalty is applied to evening (7:00 p.m. to 10:00 p.m.) hourly L_{eq} values.

The CNEL was developed for the California Airport Noise Regulations, and is applied specifically to airport/aircraft noise assessment. The L_{dn} scale is a simplification of the CNEL concept, but the two will usually agree, for a given situation, within 1 dB. Like the L_{eq}, these descriptors are also averages and tend to disguise variations in the noise environment. Because L_{dn} and CNEL presume increased evening or nighttime sensitivity, they are best applied as criteria for land uses where nighttime noise exposures are critical to the acceptability of the noise environment, such as residential developments.

Noise in the community has often been cited as being a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from the interference with human activities such as sleep, speech, recreation, and tasks demanding concentration or coordination. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases, and the acceptability of the environment for people decreases. This decrease in acceptability and the threat to public well-being is the basis for land use planning policies directed towards the prevention of exposure to excessive community noise levels. There are also economic affects of community noise: reduction in property values, inefficiency in the workplace and lost hours due to stress.

To control noise from existing fixed sources, many jurisdictions have adopted community noise control ordinances. Such ordinances are intended to abate noise nuisances and to control noise from

existing sources. They may also be used as planning tools if applied to the potential creation of a nuisance, or to potential encroachment of sensitive uses upon noise-producing facilities. Community noise control ordinances are generally designed to resolve noise problems on a short-term basis (usually by means of hourly noise level criteria), rather than on the basis of 24-hour or annual cumulative noise exposures.

2.2 Criteria for Acceptable Noise Exposure:

The *Guidelines for the Preparation and Content of the Noise Element of the General Plan* (Reference 1), includes recommendations for exterior and interior noise level standards to be used by local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The State *Guidelines* contain a land use compatibility table which describes the compatibility of different land uses with a range of environmental noise levels in terms of L_{dn} or CNEL. An exterior noise environment of 50 to 60 dB L_{dn} or CNEL is considered to be "normally acceptable" for residential uses according to those guidelines. The recommendations in the State *Guidelines* also note that, under certain conditions, more restrictive standards may be appropriate. As an example, the standards for quiet suburban and rural communities may be reduced by 5 to 10 dB to reflect lower existing outdoor noise levels.

The U.S. Environmental Protection Agency (EPA) also prepared guidelines for community noise exposure in the publication *Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (Reference 2). These guidelines are based upon assumptions regarding acceptable noise levels which consider occupational noise exposure as well as noise exposure in the home. The guidelines recognize an exterior noise level of 55 dB L_{dn} as a goal to protect the public from hearing loss, activity interference, sleep disturbance and annoyance. The EPA notes, however, that this level is not a regulatory goal, but is a level defined by a negotiated scientific consensus without concern for economic and technological feasibility or the needs and desires of any particular community. The EPA and other governmental agencies have adopted suggested land use compatibility guidelines which indicate that residential noise exposures of 55 to 65 dB L_{dn} are within acceptable limits.

For control of noise nuisances, a community noise control ordinance is the most appropriate tool. The State Office of Noise Control has prepared a *Model Community Noise Control Ordinance* (Reference 3) which contains recommended noise standards in terms of "time-weighted" sound levels. The time-weighting concept allows discrimination of both short- and long-term noise exposures, and sets allowable levels for each. The *Model* recommends more stringent standards for residential land uses than for commercial and industrial, with the most stringent standards recommended for "rural suburban" situations. The primary exterior noise standard for rural residential uses is 50 dB in the daytime hours (7 a.m. to 10 p.m.), and 40 dB at night. The standard is expressed in terms of the level exceeded for 30 minutes of an hour, equivalent to the median level, or L50. This ordinance format is successfully applied in many California cities and counties.

The U.S. Environmental Protection Agency has also prepared a Model Community Noise Control Ordinance (Reference 4), using the "Equivalent A-weighted Sound Level" (L_{eq}) as the means of defining allowable noise level limits. The EPA model contains no specific recommendations for local noise level standards, but reports a range of L_{eq} values as adopted by various local jurisdictions. The mean daytime noise standard reported by the EPA is 56.75 dB (L_{eq}); the mean nighttime noise standard is 51.76 dB (L_{eq}). This ordinance format has been successfully applied by the City and County of San Diego and by many other jurisdictions looking for a simplified approach to the enforcement of a local noise control ordinance.

In addition to the A-weighted noise level, other factors should be considered in establishing criteria for noise sensitive land uses. For example, sounds with noticeable tonal content such as whistles, horns, or droning or high-pitched sounds may be more annoying than the A-weighted sound level alone will suggest. Many noise standards apply a penalty, or correction, of 5 dB to such sounds. The effects of unusual tonal content will generally be more of a concern at nighttime, when residents may notice the sound in contrast to previously-experienced background noise.

Because many rural residential areas experience very low noise levels, residents may express concern about the loss of "peace and

quiet" due to the introduction of a sound which was not audible previously. In very quiet environments, the introduction of virtually any change in local activities will cause an increase in noise levels. A change in noise level and the relative loss of "peace and quiet" is the inevitable result of land use or activity changes in such areas. Audibility of a new noise source and/or increases in noise levels within recognized acceptable limits are not usually considered to be significant noise impacts, but these concerns should be addressed and considered in the planning and environmental review processes.

Table 2-1 is commonly used to show expected public reaction to changes in environmental noise levels. This table was developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise, or to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 to 70 dB, the usual range of voice and interior noise levels. It is probably not directly applicable to public perception of identifiable intrusive noise sources in very quiet environments because of the difference in frequency content between background noise sources and intrusive sounds, as well as the fact that the absolute amount of energy required to make a given change in sound pressure level is much smaller at low noise levels than at higher levels. Table 2-1 should therefore only be applied in a general manner to show the relationship between changes in sound energy, sound pressure levels and subjective reaction.

The comparisons of subjective reaction outlined in Table 2-1 are not applicable to noise exposures which are very quiet or very loud. For example, a whisper which is increased by 10 decibels, e.g., from 20 dB to 30 dB, remains a whisper, and would still be described as quiet. In contrast, an increase in the noise level of a diesel locomotive from 90 dB to 100 dB would be a change from a loud noise to a very loud noise. Thus the subjective reaction to a 10 dB change in either case may be different, even though the change in level is the same.

TABLE 2-1

SUBJECTIVE REACTION TO CHANGES IN NOISE LEVELS OF SIMILAR SOURCES

Increase in Sound Pressure Level, dB	Relative Increase in Acoustical Energy	Subjective Reaction
1	1.26 times	Minimum Detectable Change (Lab)
3	2.0 times	Usually Noticeable Change
5	3.2 times	Definitely Noticeable Change
10	10.0 times	Twice as Loud as Before

Sources: Various, reported by Brown-Buntin Associates, Inc.

3.0 EXISTING AND FUTURE NOISE ENVIRONMENT

3.1 Overview of Sources:

Based on discussions with City and County staff and field studies conducted by BBA, it was determined that there are a number of potentially significant sources of community noise. These sources include traffic on state highways, major county roadways and city streets, railroad operations, airport operations, military activities and industrial facilities. Specific noise sources selected for study are discussed in the following sections. Figure 3-1 shows the generalized locations of major noise sources selected county-wide for study, and for which generalized noise exposure contours have been prepared.

3.2 Methods and Noise Exposure Maps:

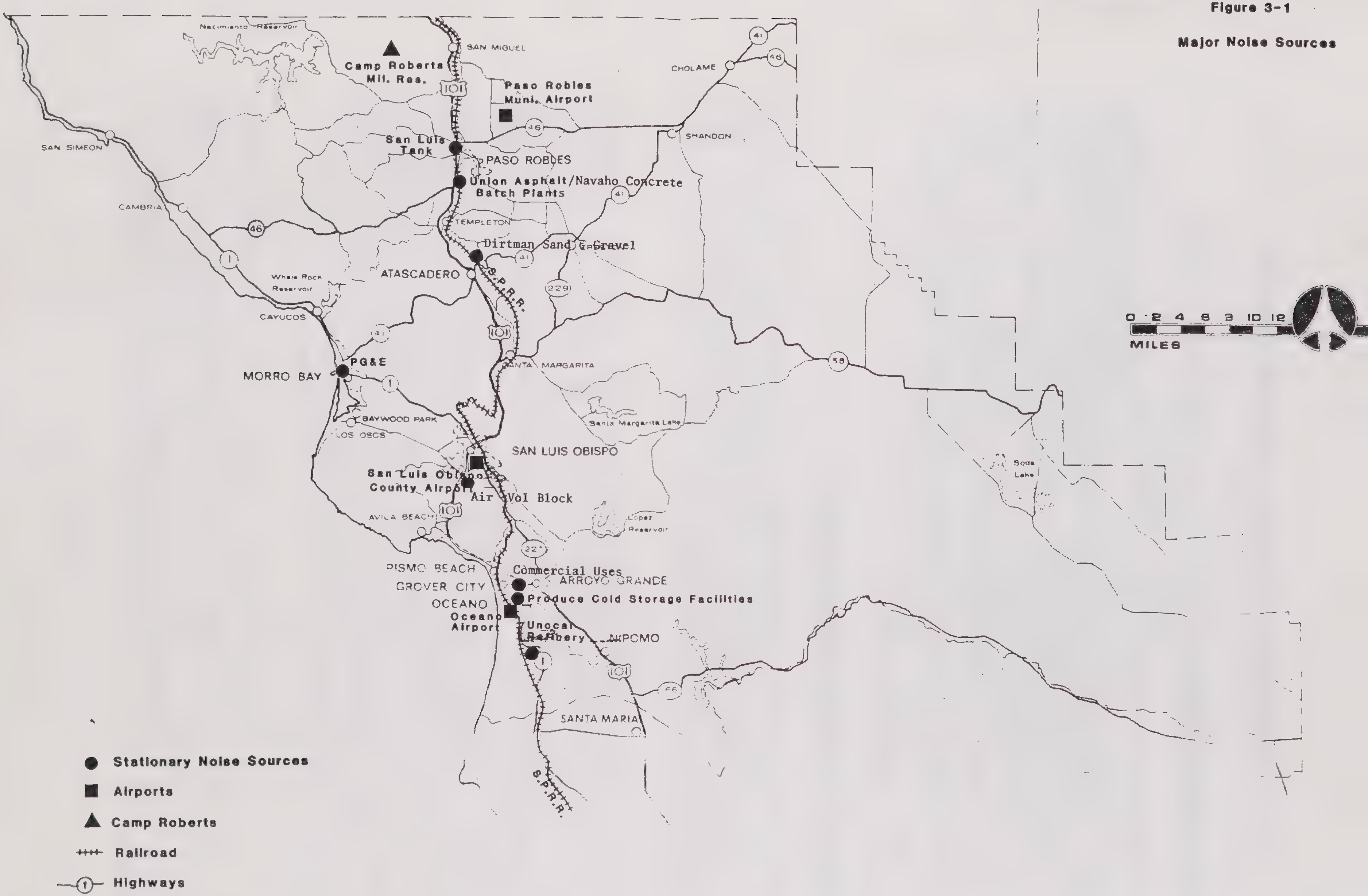
Analytical noise modeling techniques in conjunction with actual sound noise level measurements were used to develop generalized noise exposure contours for major sources of noise within the City and surrounding areas in the County for existing (1990) and future conditions.

Analytical noise modeling techniques generally make use of source-specific data including average levels of activity, hours of operation, seasonal fluctuations, and average levels of noise from source operations. Analytical methods have been developed for many environmental noise sources including roadways, railroad line operations, railroad yard operations, industrial plants and aircraft/airport operations. Such methods will produce reliable results as long as data inputs and assumptions are valid for the sources being studied. The analytical methods used in this report closely follow recommendations made by the State Office of Noise Control, and were supplemented where appropriate by source-specific sound level data to account for local conditions.

Noise exposure contours for major sources of noise are contained within the Policy Documents for each jurisdiction. The maps depict noise exposure within each of the incorporated or major unincorporated communities of the county. Noise exposure in outlying areas of the county may be derived from the tables and

Figure 3-1

Major Noise Sources



discussions of the following text which describe the distance from the center of the source to noise exposure contours. Additionally, noise exposure maps for military activities at Camp Roberts, aircraft operations at public use airports and the major stationary sources selected for study are contained within this document.

It should be noted that the noise exposure contours shown or described in this or the Policy Documents are generally based upon annual average conditions (unless otherwise noted), and are not intended to be site-specific where local topography, vegetation or intervening structures may significantly affect noise exposure at a given receiver location. The contours should be used as a screening device when determining whether a project may result in a noise-related land use conflict. Generally, a site specific study will be required to determine noise exposure in situations involving complex topography or shielding by buildings or vegetation. Where the reviewing agency wishes to estimate site-specific traffic noise exposure, adjustment factors for topography and shielding may be used as discussed in Section 3.3.1 of this document.

Users are cautioned that there may be locations where multiple noise sources impact a site, especially in the county rural areas where noise exposure maps were not prepared. The combined noise exposure in these situations may exceed the standards in Chapter 3 of the Policy Documents. An acoustical analysis should be required in these instances.

3.3 State Highways and Major County and City Roadways:

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (Reference 5) was used to develop L_{dn} contours for major traffic noise sources within the county and cities. The FHWA Model is the analytical method presently favored for traffic noise prediction by most state and local agencies, including Caltrans. The model is based upon reference energy emission levels for automobiles, medium trucks (2 axles) and heavy trucks (3 axles or greater), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver and the acoustical characteristics of the site. As recommended by Caltrans, the Calveno noise emission curves have been used in this document to

more accurately portray noise exposure along roadways in California. (The full FHWA Model is available from the Federal Highway Administration; see Reference 5).

Traffic data for existing and projected future conditions used in the calculation process were obtained from San Luis Obispo County and each of the cities of the county. For some roadways, where traffic data were unavailable, traffic counts were conducted during peak traffic periods so that estimates of daily vehicle movements could be prepared.

The FHWA Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within plus or minus 1.5 dB. To predict L_{dn} values it is necessary to determine the hourly distribution of traffic for a typical 24-hour day and to adjust the traffic volume input data to yield an equivalent hourly traffic volume. BBA experience with the use of the FHWA Model has indicated that for most situations where the roadway and receiving land use are at the same grade, the Model will generally provide a conservative (worst-case) estimate of traffic noise exposure.

3.3.1 Traffic Calibration Study:

Since many areas within the study area contain complex topographical features, a traffic calibration study was conducted to determine the types of adjustments which should be applied to calculated traffic noise levels along certain roadway segments. The findings of the traffic calibration study may also be applied to other noise sources where the height and precise location of the source with respect to the location of the receiving use are known.

The calibration study consisted of conducting sound level measurements and concurrent traffic counts in areas where the following topographic relationships between the roadway and surrounding area exist. Suitable measurement locations were found along SR1 between San Luis Obispo and Morro Bay and along SR101 between Arroyo Grande and Nipomo.

TABLE 3-1

SUMMARY OF TRAFFIC NOISE CALIBRATION STUDIES

Distance (Roadway)*	Hourly Veh. Volumes A	MT	HT	Posted Speed	L_{eq}, dB Pred.**	Meas.	Meas. Minus Pred.
Rising Topography							
100′ (SR1)	1636	16	108	55	69.1	69.5	-0.4
150′ (SR101)	2656	72	96	55	67.9	64.8	+3.1
150′ (SR101)	2868	68	140	55	68.6	65.5	+3.1
200′ (SR1)	1636	16	108	55	64.6	63.1	+1.5
300′ (SR101)	2656	72	96	55	63.3	62.8	+0.5
300′ (SR101)	2868	68	140	55	64.0	63.3	+0.7
400′ (SR1)	1636	16	108	55	60.1	62.3	-2.2
450′ (SR101)	2656	72	96	55	60.7	60.0	+0.7
405′ (SR101)	2868	68	140	55	61.4	63.5	-2.1
500′ (SR1)	1636	16	108	55	58.6	62.4	-3.8
Elevated Roadway							
100′ (SR1)	2096	52	20	55	68.4	60.8	+7.6
120′ (SR1)	1172	32	24	55	65.2	55.9	+9.3
240′ (SR1)	1172	32	24	55	60.7	57.0	+3.7
240′ (SR1)	1416	12	-0-	55	60.2	56.8	+3.4
480′ (SR1)	1416	12	-0-	55	55.7	54.9	+0.8
Roadway in Cut							
75′ (SR1)	1592	28	4	55	68.6	64.7	+3.9
150′ (SR1)	1612	44	16	55	64.7	59.1	+5.6
150′ (SR101)	2656	72	96	55	67.9	63.1	+4.8
150′ (SR101)	2868	68	140	55	68.6	63.4	+5.2

* Distance from the center of the roadway
** Calculated using the FHWA Model and Calveno noise emission curves for an acoustically "soft" site.

A = Automobiles
MT = Medium Trucks (2 axles)
HT = Heavy Trucks (3 or more axles)

Source: Brown-Buntin Associates, Inc.

- Terrain gradually rises above roadway. This is typical of many areas where a potential receptor would look down on the roadway.

- Roadway is elevated above surrounding terrain.

- Roadway is located in a cut or is below a steep embankment.

Traffic noise levels were measured in terms of the L_{eq} descriptor for 15 minute intervals while traffic counts were being conducted. Traffic counts were projected for a one-hour period and measured L_{eq} values were compared to the levels calculated by the FHWA Model using the projected hourly number of vehicles, posted speed and distance to the microphone. Calculations were based upon an acoustically "soft" site (that is, a site where absorption of sound by the ground is significant) since experience has shown that this generally provides the closest correlation with measured results. These comparisons are summarized in Table 3-1.

From Table 3-1 it may be seen that the FHWA Model generally overpredicted noise exposure in all situations. This is consistent with BBA experience with the use of the model, and is probably due mostly to the fact that the model does not account for excess ground attenuation or atmospheric absorption over distance. The greatest amount of overprediction occurred in areas which were shielded from view of all or part of the roadway by either a cut, steep embankment or elevated roadway situation. In these instances, predicted noise levels were found to be approximately 4-10 dB higher than measured levels at distances of 150 feet or less from the center of the roadway. The shielding effect was found to diminish as the distance from the roadway was increased.

For topography that rises above the roadway, such as on a hillside overlooking the roadway it was found that the FHWA Model generally overpredicted noise exposure at distances of approximately 100-200 feet from the center of the roadway and somewhat underpredicted noise exposure at distances greater than 400 feet. The greatest amount of underprediction was found to occur in instances where the observer was elevated significantly above the roadway and there was a clear view of the entire roadway surface.

Table 3-2 has been prepared to serve as a guide when applying the traffic noise exposure contour information presented later in this section to areas with varying topography. It should be noted that the adjustment factors presented in Table 3-2 are intended to provide conservative (worst-case) results, and that complex situations should be evaluated by a trained professional when the potential for significant noise impact exists.

TABLE 3-2

ADJUSTMENTS TO TRAFFIC NOISE LEVELS DUE TO TOPOGRAPHY

	Distance from Center of Roadway		
Topographical Situation	**<200'**	**200-400'**	**>400'**
Hillside overlooks roadway	-0-	+1 dB	+3 dB
Roadway is elevated (>15')	-5 dB	-2 dB	-0-
Roadway in cut/below embankment	-5 dB	-5 dB	-5 dB

Noise exposure may also be reduced when the receiver is located behind a row of houses or other buildings. The amount of shielding provided depends upon whether or not the row of buildings is continuous and effectively interrupts line-of-sight between the noise source and receiver. Shielding by buildings can reduce noise exposure by up to 15 dB.

It is commonly assumed that trees and other vegetation can provide significant noise attenuation. However, approximately 100 feet of dense foliage (so that no visual path extends through the foliage) is required to achieve a 5 dB attenuation of traffic noise. For this reason, the use of vegetation as a noise barrier should not be considered a practical method of noise control unless large tracts of dense foliage are a part of the existing landscape.

3.3.2 <u>Traffic Counts</u>:

In some instances, traffic counts were not available from the cities for individual roadways which were thought to have the potential for generating significant noise levels. For these roadways, short-term traffic counts were performed during the peak

hours of either 7:00 a.m. - 8:30 a.m. or 4:00 p.m. - 5:30 p.m. to provide a basis for estimating annual average daily traffic (AADT). Counts were generally conducted for a period of 15 minutes and then projected for an hour. For the purposes of this study, AADT values were then calculated based on the assumption that peak hour traffic flows represent approximately 10 percent of the AADT. A summary of the traffic counts and estimated AADTs are shown in Table 3-3.

3.3.3 **Traffic Noise Exposure Calculations**:

Traffic data representing annual average daily traffic volumes (AADT), truck mix and the day/night distribution of traffic for existing (1990) and future conditions were obtained from Caltrans, San Luis Obispo County, and the City. For the county and the Cities of Morro Bay and Paso Robles, the future situation was assumed to be the year 2010. For the state highways in the county or the cities, the future situation was assumed to be 2010, except for Highway 101 which was assumed to be 2005. Future traffic volumes for a few county and city roadway segments were estimated by BBA based upon growth rates for comparable roadways since these data were not available from the jurisdiction. Traffic data used in the traffic noise exposure modelling process are summarized in Appendix A. The odd numbered segments in Appendix A refer to existing traffic volumes and the even numbered segments refer to future traffic volumes.

Using the FHWA Model and the traffic data summarized in Appendix A, the distances from the center of the roadway to the 60, 65 and 70 dB L_{dn} contours for existing and projected future traffic conditions were calculated. Contour distances are summarized in Table 3-4. Table 3-4 is subdivided into city streets, state highways and rural county roadways. Roadway segments listed in Table 3-4 refer to the traffic data print-out summarized in Appendix A. Noise contour calculations generally were performed only for roadways which had an existing or projected future ADT of 5000 or greater, since at lower traffic volumes the 60 dB L_{dn} contour would be confined to an area closer to the roadway than normal residential setbacks. Where medium and heavy truck volumes were greater than about 5% or where speeds were greater than 50 mph, noise contours were calculated for roadways with less than 5000 AADT. The approximate locations of

the 60 dB L_{dn} contours for existing and projected future conditions are shown on maps contained within the Policy Document.

It should be noted that since noise contour calculations did not take into consideration shielding caused by local buildings or topographical features, the distances reported in Table 3-4 and depicted in the noise exposure maps should be considered worst-case estimates of noise exposure. Noise exposure behind the first row of houses or other types of buildings may be reduced by up to 15 dB. The effects of elevated or depressed roadways or other topographic features, which are common along many roadway segments throughout the county, are described in Section 3.3.1 of this document.

Simple adjustments to traffic noise levels shown in Table 3-4 can be made using Figure 3-2 if a new or different AADT is assumed. For example, if it is known that a highway with an AADT of 10,000 produces a noise level of 60 dB L_{dn} at 200 feet, the noise level at that same distance can be calculated if the AADT increases to 20,000 (assuming no changes in other traffic conditions, such as percentage of truck traffic and speed). From Figure 3-2 it can be seen that a +100% change in traffic volume (10,000 to 20,000) increases the relative noise level by +3 dB. Therefore, the new traffic noise level is 63 dB L_{dn} (60 dB +3 dB) at 200 feet.

TABLE 3-3

SUMMARY OF TRAFFIC COUNTS WITHIN PASO ROBLES

City Street	Date	Time	Observed Peak Hour Volume	Estimated* ADT	Obsv. MT (%)	Obsv. HT (%)	Posted Speed (MPH)
Charolais Rd. (east of River Rd.)	8/28/90	5:50 pm	21	210	0	0	45
Golden Hill Rd. (south of Union Rd.)	8/28/90	5:32 pm	404	4,040	4.1	0	45
Union Rd. (west of Golden Hill Rd.)	8/28/90	5:32 pm	140	1,400	2.9	0	45
Union Rd. (east of Golden Hill Rd.)	8/28/90	5:32 pm	544	5,440	3.8	0	45
Airport Rd. (north of Dry Creek Rd.)	8/28/90	5:20 pm	288	2,880	2.8	0	45
Meadowlark Rd. (west of Falcon Dr.)	8/28/90	6:20 pm	12	120	0	0	35
Scott St. (west of Commerce Way)	8/28/90	6:05 pm	198	1,980	3.0	0	35

* Assumes that the peak hour traffic volume is equal to 10% of the ADT

MT = Medium Trucks (2 axles)

HT = Heavy Trucks (3 or more axles)

Source: Brown-Buntin Associates, Inc.

TABLE 3-4

NOISE CONTOUR DATA
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO L_{dn} CONTOURS

Segment Nos.	Description	Existing			Future		
		60 dB	65 dB	70 dB	60 dB	65 dB	70 dB
STATE HIGHWAYS							
Highway 46							
43-44	Jct. Route 1 to Vineyard Dr.	77	36	16	88	41	19
45-46	Vineyard Dr. to Jct. Route 101	102	47	22	121	56	26
47-48	Jct. Route 101 to Paso Robles Airport Rd.	600	278	129	773	359	167
49-50	Paso Robles Airport Rd. to Jct. Route 41	494	229	106	704	327	152
51-52	Jct. Route 41 to Kern County	331	153	71	471	219	101
Route 101							
71-72	Grand Ave. (SLO) to S. Paso Robles Interchange	861	400	185	1,420	659	306
73-74	S. Paso Robles Intchg. to Jct. Route 46 East	674	313	145	1,156	537	249
75-76	Jct. Route 46 East to South San Miguel Intchg.	669	311	144	981	455	211
COUNTY AREA ROADS							
Salinas River/Adelaida							
131-132	Las Tablas (Route 46 to Bethel Rd.)	75	35	16	86	40	18
133-134	Las Tablas (Bethel Rd. to Hwy 101)	75	35	16	228	106	49
135-136	Las Tablas (east of Hwy 101)	61	28	13	95	44	20
137-138	Main St. (Old County Rd. to Vineyard Dr.)	84	39	18	161	75	35
139-140	Main St. (north of Old County Rd.)	84	39	18	211	98	45
141-142	Nacimiento Lake Dr. (east of Chimney Rock Rd.)	108	50	23	187	87	40

TABLE 3-4 (Continued)

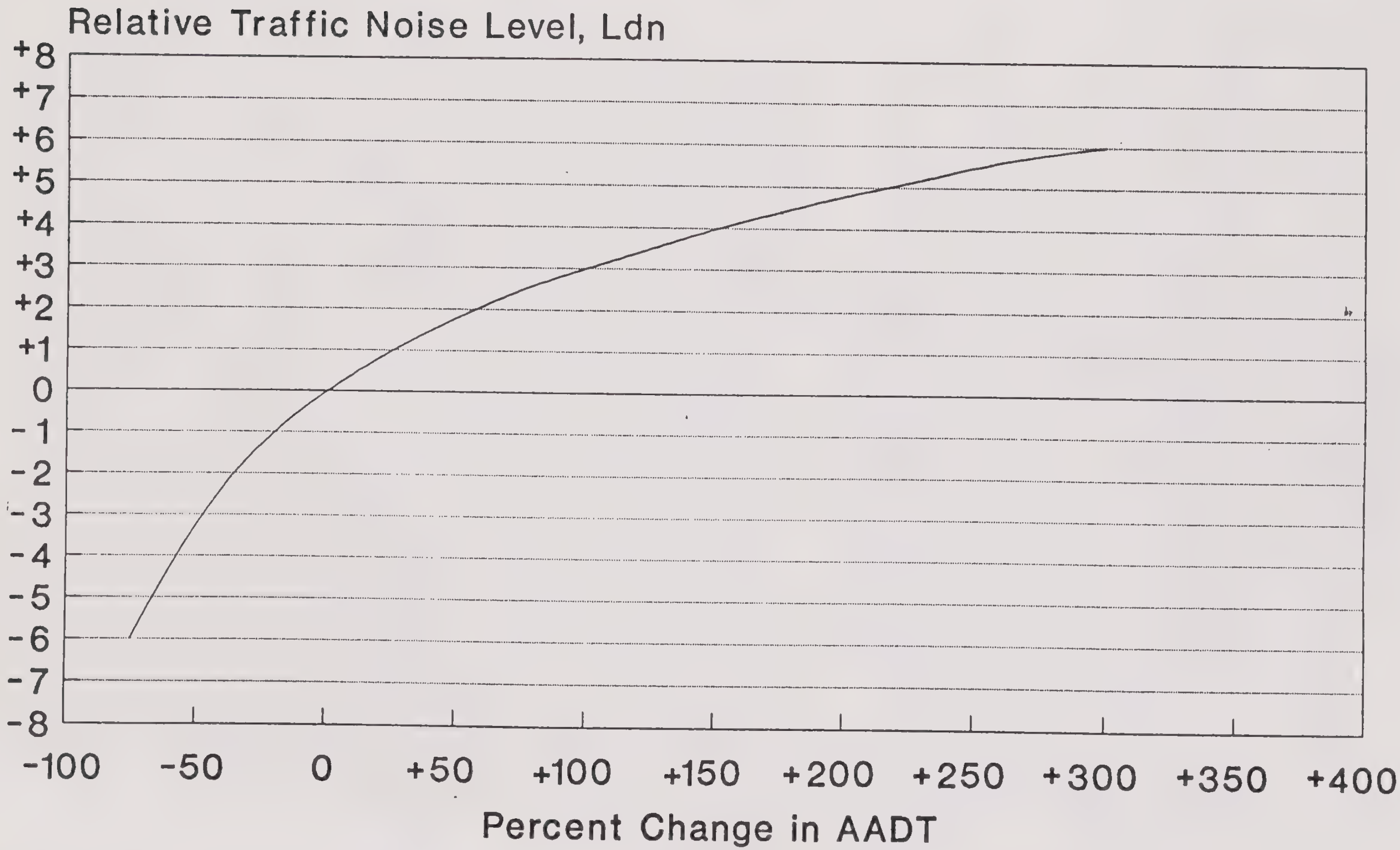
NOISE CONTOUR DATA
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO L_{dn} CONTOURS

Segment Nos.	Description	Existing 60 dB	Existing 65 dB	Existing 70 dB	Future 60 dB	Future 65 dB	Future 70 dB
Paso Robles							
295-296	Creston Rd.	122	56	26	379	176	82
297-298	Niblick-Sherwood-Linne Rds.	97	45	21	260	121	56
299-300	Charolais Rd.	26	12	6	288	134	62
301-302	Spring St.	98	45	21	138	64	30
303-304	Golden Hill Rd.	91	42	20	446	207	96
305-306	Union Rd. (west of Golden Hill Rd.)	34	16	7	107	50	23
307-308	Union Rd. (east of Golden Hill Rd.)	49	23	11	141	65	30
309-310	24th St./Nacimiento Lake Rd.	77	36	17	142	66	31
311-312	South Vine St.	33	15	7	56	26	12
313-314	Airport Rd.	59	27	13	-	-	-

Note: Refer to the "Airport Master Plan and Airport Specific Plan for the Paso Robles Municipal Airport" for future noise contours on Airport Road.

Source: Brown-Buntin Associates, Inc.

Figure 3-2
Percent Change In Annual Average Daily Traffic (AADT) Compared To Traffic Noise Level



Note: All other traffic conditions are unchanged

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3.4 **Railroad Noise**:

The mainline of the Southern Pacific Railroad (S.P.R.R.) passes through the county generally in a north-south direction. According to railroad officials there are presently two freight and two passenger train movements per day within the San Luis Obispo County area. One of the freight trains generally passes through the county at night between the hours of 10:00 p.m. and 7:00 a.m. Estimates of future railroad operations were not available from the railroad, although it is likely that the number of train movements could increase.

There are a variety of railroad operating conditions which occur in San Luis Obispo County due to the presence of grade crossings, curves, grades and congested areas within cities or unincorporated communities. For this reason, speeds and the use of the warning horn vary considerably from location to location.

In order to document railroad noise exposure within different areas of the county where residential or other noise-sensitive development has occurred, measurements of noise levels generated by individual train passbys were conducted. Measurement sites were selected to quantify the effects of grade crossings, grades and variations in speeds.

The results of railroad noise level measurements are summarized in Table 3-5. From Table 3-5 it is apparent that measured sound levels from railroad passbys as defined by the Sound Exposure Level (SEL) at approximately 100 feet from the tracks ranged from approximately 98-101 dB for freights and 93-104 dB for passenger trains. At approximately 50 feet from the tracks, SEL values were approximately 110 dB for a freight train and 87-106 dB for passenger trains. The most significant variable in measured levels was whether or not the horn was in use during the measurements.

Railroad noise exposure may be quantified in terms of L_{dn} using the following formula:

$$L_{dn} = \overline{SEL} + 10 \text{ Log } N_{eq} - 49.4$$

where,

$\overline{SEL}$ is the average SEL for a train passby,

N_{eq} is the equivalent number of passbys in a typical 24-hour period determined by adding 10 times the number of nighttime events (10:00 p.m-7:00 a.m.) to the actual number of daytime events (7:00 a.m.-10:00 p.m.), and 49.4 is a time constant equal to 10 log the number of seconds in the day.

Operational data used for the calculation of railroad noise exposure for existing conditions were obtained from the railroad. For future conditions, an estimate was developed by BBA in conjunction with county staff which includes ten freight and four passenger trains per day. Fifty (50) percent of the freight trains and one of the passenger trains would pass through the county during the nighttime hours. This should be considered a worst-case estimate of future railroad operations.

Using the above-described railroad noise level and operational data, the distances from tracks to the L_{dn} 60, 65 and 70 dB contours were calculated for existing and future conditions. Calculated distances are summarized in Table 3-6. The mean SEL values at 100 feet used for the calculations for areas away from grade crossings and horn usage were 94.5 dB for passenger trains and 99.7 dB for freight trains. For areas within 1000 feet of grade crossings where horns are likely to be used, mean SEL values used for calculations were 100.4 dB for passenger trains and 101.7 dB for freight trains. As shown by the data presented in Table 3-5, noise levels from individual trains passbys can vary considerably from event to event.

TABLE 3-5

SUMMARY OF RAILROAD NOISE LEVEL MEASUREMENT DATA
SOUTHERN PACIFIC TRANSPORTATION COMPANY

Location	Date	Time	Type	Dir	Distance (Feet)	#Locos/ #Cars	Speed (mph)	Lmax	SEL (dB)	Horn
Atascadero										
Hwy 41 and SPRR	8/21/90	2:18 pm	P	S	100	---	60	86.7	97.0	N
	8/21/90	2:45 pm	F	N	100	---	50	85.0	98.7	N
Santa Margarita										
West of Wilhelma Ave. Crossing	8/28/90	2:00 pm	P	S	100	3/15	35	105.0	104.2	Y
	8/28/90	4:07 pm	P	N	100	2/15	35	96.0	100.8	Y
	8/28/90	4:52 pm	F	N	100	4/65	25	90.0	98.4	Y
East of Wilhelma Ave. Crossing	8/28/90	2:00 pm	P	S	100	3/15	35	87.9	94.1	Y
	8/28/90	4:07 pm	P	N	100	2/15	40	83.1	92.7	Y
	8/28/90	4:52 pm	F	N	100	4/65	25	83.8	97.6	Y
Oceano										
Railroad St. near Highway 1	8/22/90	3:05 pm	P	S	110	2/13	---	82.0	92.5	N
	8/23/90	2:45 pm	F	N	110	---	---	88.0	98.4	N
	8/24/90	3:14 pm	P	S	110	---	---	92.0	98.0	N
South of Oceano near Callender	8/29/90	9:00 am	F	S	120	4/55	55	92.0	101.3	N
San Luis Obispo										
Near Industrial Way	8/21/90	3:04 pm	P	N	48	2/16	40	84.5	92.9	N
	8/21/90	3:30 pm	P	S	54	2/15	40	101.0	104.6	Y
Near Marsh St.	8/24/90	2:19 pm	P	S	50	---	40	78.0	87.0	N
	8/24/90	3:00 pm	P	N	50	---	40	103.0	105.5	Y
	8/24/90	3:50 pm	F	N	50	---	40	104.0	109.5	Y

Source: Brown-Buntin Associates, Inc.

TABLE 3-6

DISTANCE (FEET) FROM CENTER OF TRACK TO L_{dn} CONTOURS - SOUTHERN PACIFIC TRANSPORTATION COMPANY SAN LUIS OBISPO COUNTY

	Existing		Future*	
L_{dn} Contour Values	w/o Horn	w/Horn	w/o Horn	w/Horn
70 dB	25′	35′	76′	113′
65 dB	53′	76′	163′	244′
60 dB	115′	163′	352′	525′

* Based on a hypothetical operational scenario consisting of 10 freight and 4 passenger trains per day.

Source: Brown-Buntin Associates, Inc.

3.5 Airports:

Paso Robles Municipal Airport (PRB), a public use airport, was evaluated as part of the Noise Element study. Noise level data from previous studies were utilized to illustrate areas in the airport environs where aircraft noise levels potentially exceed the noise level standards established by state law or the adopted policies of this Noise Element. It should be noted that the airport noise exposure map shown in Figure 3-3 depicts noise levels of aircraft in flight. Noise levels from aircraft engine runups on the ground and other stationary noise sources at the airports were not studied during the preparation of this document. It is unknown if these sources are significant.

The State of California requires that aircraft noise be quantified in terms of the CNEL descriptor in California Code of Regulations (CCR) Title 21. CNEL is considered to be equivalent to the L_{dn} descriptor used for other noise sources addressed in this document within approximately ± 1 dB.

Noise exposure information for PRB was derived from a noise study prepared by BBA for the Chandler Ranch Specific Plan EIR (Reference 6). Noise exposure maps were prepared for this study using Version 3.9 of the FAA's Integrated Noise Model (Reference 7). Included in the study were four operational scenarios representing existing (1990) and three 20-year forecast (2010) conditions. The 20-year forecasts were based upon minimum, mid-range and maximum projections of aircraft use. Following is a summary of the total number of annual aircraft operations assumed for each operational scenario.

- 1990 - 91,500 (44% Helicopters)
- 2010 (Minimum) -159,000 (51% Helicopters)
- 2010 (Mid-range) -306,500 (52% Helicopters)
- 2010 (Maximum) -457,000 (53% Helicopters)

From the above it is apparent that operations at the airport could increase significantly when compared to existing operations. Many of these additional operations would be training operations by light helicopters such as the Bell 206. The helicopter training pattern is on the west side of the airport runway system.

Figure 3-3 shows the 2010 CNEL contours for the maximum growth scenario. This map is thought to be representative of potential worst-case conditions at the airport, and assumes that the aircraft fleet would include approximately eight (8) percent business jet (turbo jet or turbo fan) aircraft operations. This map may be used for land use planning purposes to identify areas around the airport which could be exposed to excessive noise levels. More detailed information is available from Reference 6.

The airport master plan for PRB is presently being revised. New noise exposure maps will be prepared as a part of that study. When the maps are published, they should be incorporated by reference into this document.

Figure 3-3: Paso Robles Municipal Airport(2010-Maximum Forecast)

3.6 **Major Stationary Noise Sources**:

The production of noise is an inherent part of many industrial, commercial and agricultural processes, even when the best available noise control technology is applied. Noise production within an industrial or commercial facility or in close proximity to many types of agricultural equipment is controlled indirectly by Federal and State employee health and safety regulations (OSHA and Cal-OSHA), but exterior noise emissions from such operations have the potential to exceed locally acceptable standards at nearby noise-sensitive land uses.

Noise control issues focus upon two objectives: to prevent the introduction of new noise-producing uses in a noise sensitive area, and to prevent encroachment of noise-sensitive land uses upon existing noise-generating facilities. The first objective can be achieved by applying performance standards to proposed new industrial or other noise generating uses. The second objective can be met by requiring that new noise-sensitive uses in proximity to existing noise sources include receiver-based mitigation measures to ensure compliance with the same performance standards.

Noise exposure information for the major stationary noise sources selected for study by the City and County was developed from operational data obtained from source operators and from noise level measurements conducted at reference locations around the noise sources. Consistent with the L_{dn} methodology, a 10 dB penalty was added to noise levels occurring at night (10:00 p.m. - 7:00 a.m.) where nighttime operations occur. In discussing future operations with source operators it was readily apparent that too many variables exist to allow meaningful projections of future activity or noise levels.

Following are discussions of major stationary noise sources which were identified by the City and County for study. The discussions are intended to provide generalized information concerning the relative noise impacts of each source, and to identify specific noise sources which should be considered in the review of development proposals where potential noise conflicts could result. The following discussions do not represent a comprehensive accounting of all noise sources within the City or its Planning

Impact Area. It is probable that unidentified industries or other major noise sources exist in the County which generate significant noise levels and could result in noise-related land use conflicts. Generalized noise exposure contours showing areas potentially exposed to noise levels of 45 and 50 dB L_{eq} were prepared for major stationary noise sources in instances where it was determined that such contours would be located off the property occupied by the source and potentially impact existing or future noise-sensitive land uses. The 45 dB L_{eq} contour has been shown only in instances where there are nighttime operations by the source. These contours are included in Appendix B of this document. It is intended that the generalized contours contained within Appendix B be used as a screening device to determine when potential noise-related land use conflicts may occur and when site-specific studies may be required to properly evaluate noise at a given noise-sensitive receiver location.

3.6.1 Commerce/Chandler Area, Paso Robles:

This industrial area includes various manufacturing plants located on Commerce Way and south of Sherwood Road. It is unknown if any of the business operate at night. Those that were observed to produce noise included the following:

- Beckman Industries - 51 dB L_{eq} at 75 feet from air handling units. The 50 dB L_{eq} contour is estimated to be at 84 feet from the air handling units.

- Morro Bay Cabinets - 65 dB L_{eq} at 75 feet from the air exhaust fans. The 50 dB L_{eq} contour is estimated to be at 422 feet from the air exhaust fans.

- Advance Adaptors - 49 dB at 250 feet south of building. The 50 dB L_{eq} contour is estimated to be at 222 feet from the building.

- Ennis Business Forms - 61 dB L_{eq} at the mobile home park fence north of the plant. The 50 dB L_{eq} contour is estimated to be 1060 feet from the building.

3.6.2 <u>North River Road Area, Paso Robles</u>:

Businesses in this area include a concrete "redi-mix" plant, auto body shop, grading and paving company, Junk Tique, Precision Collision, A-1 Welding, Ole Viborg, Inc., River Road Ready-Mix, Inc., River Road Mini Storage and Stemper Brothers Construction. No significant noise emissions were noted from any of these business during the survey. The greatest potential for noise is probably from the concrete "redi-mix" plant. There are no noise-sensitive receivers near the area.

3.6.3 <u>San Luis Tank, Paso Robles</u>:

San Luis Tank is located near 26th Street and east of Spring Street. The facility manufactures oil and water storage tanks. Principal noise sources associated with the plant are the cutting, grinding and welding of sheet metal. The plant typically operates from 6:00 a.m. - 5:00 p.m. and occasionally operates until midnight. Residences are located on the west side of the plant about 200 feet from outdoor operations. Measured sound levels at this location were an L_{eq} 61 dB and an L_{max} of 67 dB. The sources of noise were grinding and banging of sheet metal. Along 26th Street south of the plant, the measured sound level was an L_{eq} of about 58 dB. It is estimated that the 45 and 50 dB L_{eq} contours would be located approximately 1260 and 710 feet, respectively, from the west side of the plant. Noise contours in other directions from the plant would be far less extensive due to shielding provided by the plant structures. The approximate locations of the 45 and 50 dB L_{eq} contours are shown in Appendix B of this document and in the Policy Document.

3.6.4 <u>Union/Golden Hills Road Area, Paso Robles</u>:

The only businesses in this area that were noted to have noise emissions were the following:

- NCI Affiliates, Inc. - 56 dB L_{eq} at 75 feet. The approximate location of the 50 dB L_{eq} contour is at 150 feet from the building.

- Paso Robles Welding - occasional banging and clanging of pipes resulted in L_{max} values ranging from 67-77 dB. The average sound level as defined by the L_{eq} appears to be insignificant.

3.6.5 Union Asphalt Batch Plant, San Luis Obispo County:

Union Asphalt is located on Ramada Drive north of Marquita Avenue between Templeton and Paso Robles within Subarea "F" of the City's Planning Impact Area. The Union Asphalt plant produces hot asphalt. Noise producing equipment includes an asphalt burner, shaker, a front loader, a sand hopper and conveyor system, a dump truck, and a pub mill. Heavy trucks are used for the transport of raw materials and the finished product. Operations are reported to be 5:30 a.m.-4:00 p.m. during a typical busy season, which lasts from August through November. Operations are on demand and could conceivably run 24 hours per day, although this is not typical. Truck traffic at the plant is reported to be approximately 30 round trips per day. Noise measurements were conducted on August 28, 1990 at three locations on the plant property while the plant was in full operation. The asphalt burner was the dominant source of noise to the west of the plant. Measured L_{eq} values were 91 dB at 50 feet and 86 dB at 100 feet from the front of the burner. The shaker was the dominant noise source to the north of the plant. L_{eq} values measured in this direction were 74 dB at 50 feet and 73 dB at 100 feet. The shaker and burner were also the dominant noise sources to the east of the plant. L_{eq} values measured in this direction were 80 dB at 50 feet and 77 dB at 100 feet from the rear of the burner. The estimated distances to the 50 dB L_{eq} contours are approximately 6,000 feet from the front of the burner, 2,200 feet from the side of the burner, and 1,400 feet from the rear of the burner. All distances assume that there is no local shielding by buildings or topography, and are therefore worst-case estimates of noise exposure. The approximate locations of the 45 and 50 dB L_{eq} contours are shown in Appendix B of this document and in the Policy Document.

Union Asphalt is currently planning noise mitigation in the form of a housing around the asphalt burner. Within the next year, they plan to install a quieter burner. New models of asphalt burners

could be up to 5 dB quieter than the existing burner, with the actual difference varying with the manufacturer.

Contact: Ron Root

3.6.6 Navajo Concrete Batch Plant, San Luis Obispo County:

Navajo Concrete is located on Ramada Drive north of Marquita Avenue between Templeton and Paso Robles within Subarea "F" of the City's Planning Impact Area. Navajo Concrete produces ready mix concrete. Noise producing equipment includes a front loader, cement mixers, gravel trucks, and a weigh hopper. Operations are reported to be 4:00 a.m.-2:00 p.m. on week days, and 4:00 a.m.-12:00 p.m. on Saturdays. Truck traffic at the plant is reported to be typically 32 round trips per day with a worst-case of 200 round trips per day. Noise measurements were conducted on August 28, 1990 on the plant property. The weigh hopper and front loader were the dominant sources. Average sound levels measured were 77 dB at 50 feet and 71 dB at 100 feet. The 45 and 50 dB L_{dn} contours are located at approximately 2000 and 1100 feet, respectively, from the center of the noise source, and are shown in Appendix B of this document and in the Policy Document.

Contact: Albert Lewis

3.6.7 Agricultural Operations:

Although specific noise sources related to agriculture were not studied as a part of this Noise Element, such operations are common in the rural areas of the county and have the potential to produce significant noise impacts. The following is a list of typical operations or equipment for which noise level measurements have been obtained in Tulare County. This noise exposure information should be used as a general guide to identify potential noise conflicts.

Equipment/Operation	Noise Level, dB	Distance (Ft.)
Wind Machine (National Frost 391 G.P., 391 cu. in. Ford V-8 engine)	91-92 61-71	50 350
Cotton Gin	74-77	120
Diesel Engine	74-85	50
Aerial Application Aircraft (Crop Dusters)		
Piper Brave (400 H.P./3-bladed prop.)	85-88	600
Grumman Ag Cat (600 H.P./2-bladed prop.)	103	100-150
Turbine Thrush (800 H.P./3-bladed prop.)	90-95	100
Cotton Pickers	58	500
Large Tractor	72-75	150
Small Tractor	69-79	50

3.7 Camp Roberts:

Camp Roberts is a training site for the California Army National Guard (CAANG). It is located along Highway 101 about eight miles north of Paso Robles. The mission of Camp Roberts is to provide ranges and maneuver areas for the CAANG. Noise impacts associated with the facility originate from ground-based sources such as artillery, demolitions, and small arms fire, and from fixed and rotary-wing aircraft (helicopters). Noise impacts associated with ground-based sources are described by a report prepared by Department of the Army (Reference 11). As yet, the Army has not completed its study of aircraft noise. The following discussion of ground-based noise impacts is based on Reference 11, and the discussion of aircraft noise is based on information provided by Mr. Brian J. Duke, Environmental Planner for Camp Roberts, and general information contained in BBA files for military aircraft.

Military Ground-Based Noise Impacts: The Army describes high amplitude noise resulting from armor, artillery and demolition activity in terms of the C-weighted Day/Night Average Level (CDNL). C-weighting measures the low frequency component of blast noise that can cause buildings and windows to shake. Like the A-weighted

Day/Night Average Level (L_{dn}) commonly used to evaluate community noise, CDNL is the energy average of noise during a 24-hour period with a 10 dB penalty applied to noise that occurs between 10:00 p.m.-7:00 a.m. Noise from small arms fire is described by unweighted (linear) peak sound pressure levels (dBP). The dBP weights all frequencies of noise equally, and measures the maximum instantaneous sound pressure level during an event. The Army has found the dBP to be the best predictor of annoyance from small arms fire.

The Army has defined noise zones based on CDNL and dBP values. The levels of acceptability for CDNL and dBP were determined through social surveys. Table 3-7 summarizes the acceptability of various noise zones and the corresponding CDNL and dBP limits.

TABLE 3-7

NOISE ZONES AND ACCEPTABILITY LIMITS

		Noise Limits	
Zone	**Description**	**CDNL**	**dBP**
I	Acceptable	<62 dB	<87 dB
II	Normally Unacceptable	62-70 dB	87-104 dB
III	Unacceptable	>70 dB	>104 dB

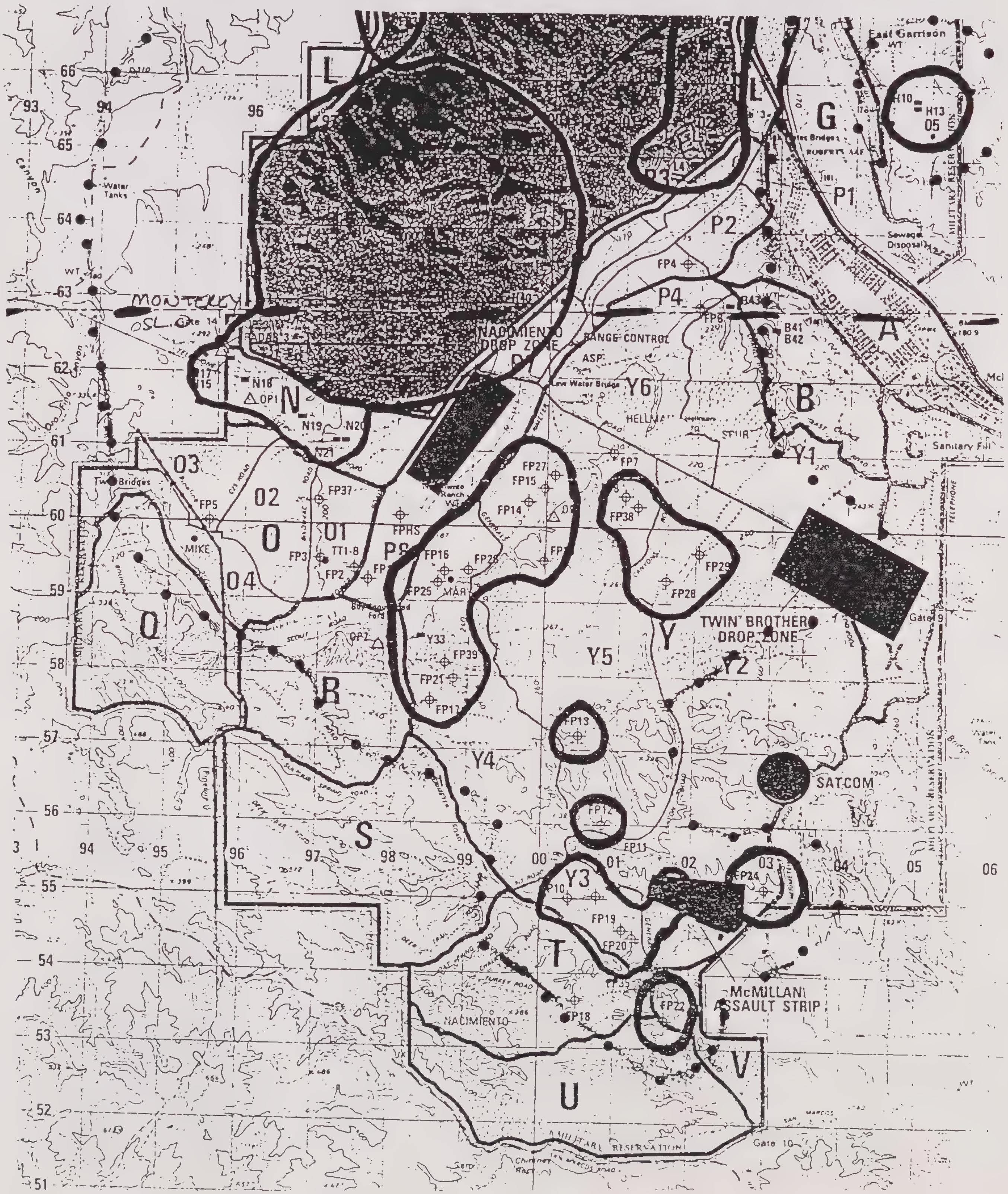
Source: Reference 11

Zones II and III are generally confined to the military reservation at Camp Roberts but do extend into civilian areas within Section 1, T.22S.,R.10E. and Sections 35 and 36, T.22S.,R.11E., SBBM. The approximate locations of the Zone II and III protrusions are shown in Figure 3-4. The Army recommends that civilian planning agencies coordinate with Camp Roberts to ensure compatible development in Zone II and III areas.

Military Aircraft Noise Impacts: Both helicopters and fixed-wing aircraft perform training missions within and adjacent to the Camp Roberts airspace. The military has not completed its study of aircraft noise. Helicopters based at Camp Roberts include the single rotor Bell UH-1 ("Huey") and the twin rotor Boeing CH-47 (Chinook). Fixed-wing jet aircraft which fly over the base are not based at Camp Roberts but originate from other facilities. The most common aircraft used in ground support training activities is the Fairchild A-10 (Thurderbolt II). It is expected that noise from helicopter and fixed wing aircraft will be audible off the military reservation. Noise levels will depend on the distance and height of the aircraft, power settings and other factors. When the Army completes its aircraft noise evaluation, the findings of the study should be incorporated by reference into this document.

FIGURE 3-4

Camp Roberts Noise Zones



• • • Zone II

▬▬ Zone III

BBA

4.0 COMMUNITY NOISE SURVEY

As recommended by the Government Code and ONC Guidelines, a community noise survey was conducted to document noise exposure in representative areas of the county and cities containing noise-sensitive land uses. The following noise-sensitive land uses have been identified for the purpose of this survey

1. All residential uses
2. Schools
3. Long-term care medical facilities, such as hospitals, nursing homes, etc.
4. Office buildings
5. Parks

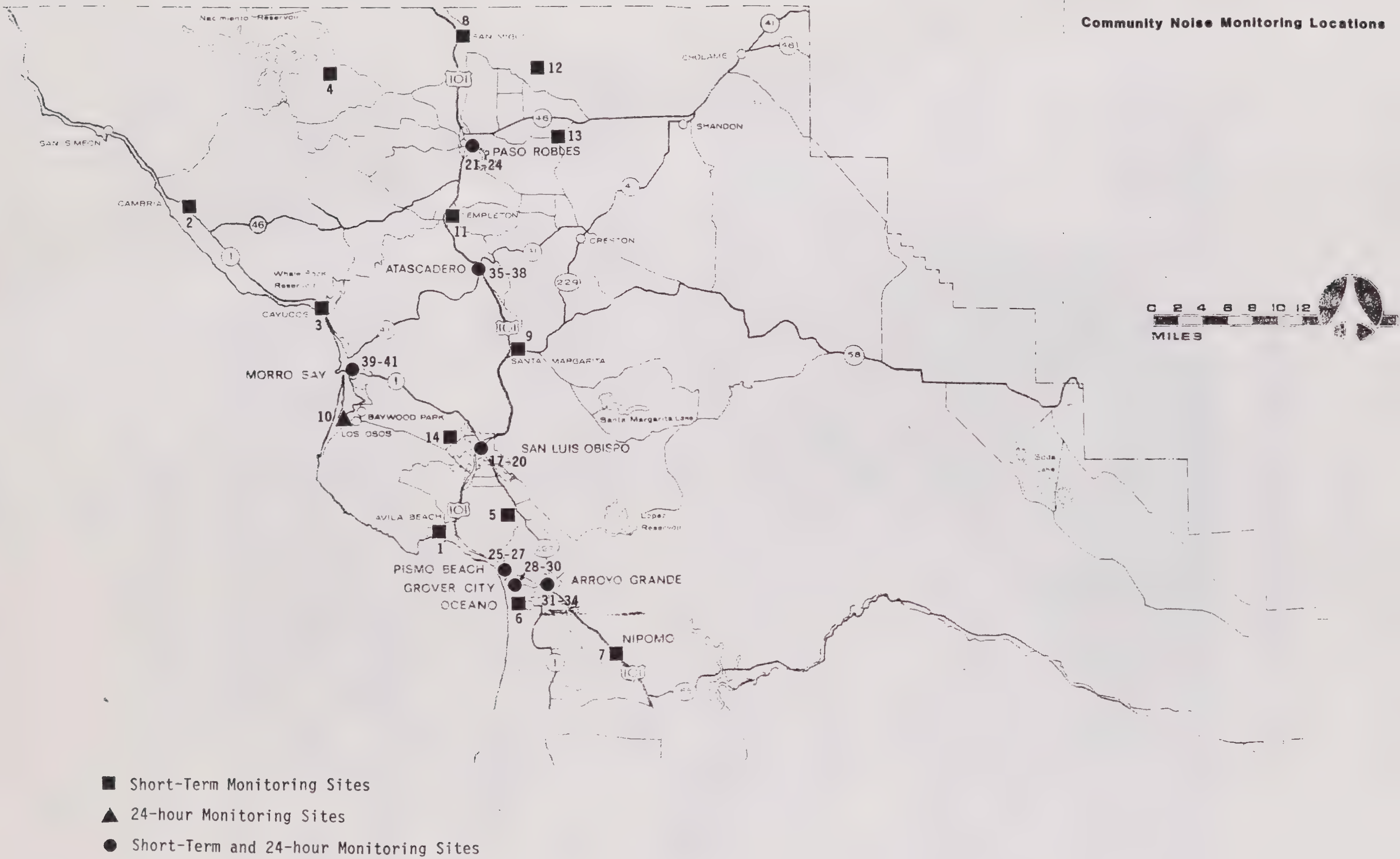
Noise monitoring sites were selected to be representative of typical conditions where such uses are located. A total of 41 monitoring sites were selected county-wide as shown in Figure 4-1 (4 sites were selected in Paso Robles). A combination of short-term and continuous noise monitoring was used to document existing noise levels at these locations during August, 1990.

At 33 of the community noise survey sites, noise levels were sampled for approximately 15 minutes during each of three periods of the day and night so that reliable estimates of L_{dn} could be prepared. The data collected during the short-term sampling program included the L_{eq}, maximum noise level, minimum noise level and a description of noise sources which were audible at the monitoring sites.

Continuous noise monitoring was conducted at eight of the community noise survey sites to document fluctuations in noise levels over a typical 24-hour period within the different types of noise environments (City, County Rural Area, County Urban/Village Area). Noise level data collected during continuous monitoring included the L_{eq}, maximum noise level and the statistical distribution of noise levels for each hour of the sample period.

Figure 4-1

Community Noise Monitoring Locations



Noise level data collected during the community noise survey are summarized in Table 4-1. Typical hourly fluctuations of noise levels at the sites where continuous noise monitoring was conducted are shown in graphic form in Figures 4-2 through 4-9. Hourly L_{eq} values shown in these figures are representative of energy average sound levels, and are very sensitive to single events such as vehicle or railroad passbys or aircraft overflights. L_{max} and L_{min} values represent the maximum and minimum values measured each hour.

The community noise survey results indicate that typical noise levels in noise-sensitive areas range from approximately 39-62 dB L_{dn}. As would be expected, the quietest areas are those which are removed from major transportation-related noise sources and local industrial or other stationary noise sources. Good examples of these quiet areas are the County Rural Areas defined by the El Pomar-Estella, San Luis Obispo and South County Planning Areas and some of the County Urban/Village Areas such as at Heritage Ranch. The noisier locations monitored during the survey were in areas located near Highway 101 and major local streets.

Maximum noise levels observed during the survey were generally caused by local automobile traffic or heavy trucks. Other sources of maximum noise levels included occasional aircraft overflights, construction activities and nearby industrial/commercial equipment or machinery. Background noise levels in the absence of the above-described sources were generally caused by distant traffic, wind, birds, the surf or insects.

One factor that is difficult to quantify, but is often mentioned by persons who reside in rural areas, is the greater expectation for a quiet living environment by persons who have made the choice to live away from urbanized areas. This factor, coupled with the quiet existing background noise levels discussed above, greatly increases the likelihood that noise from a new noise generating land use will be perceived by residents of these areas as a significant intrusion over existing conditions.

Results of the community noise survey indicated that existing background noise levels in many areas of the county that contain noise-sensitive land uses are relatively quiet. To preserve quiet conditions, noise level standards and policies (see Policy Document) have been adopted which will prevent degradation of the existing noise environment as much as possible.

TABLE 4-1

SUMMARY OF COMMUNITY NOISE SURVEY DATA (for Paso Robles and Surroundings)

Map. Loc. #	Location	Level, dB L_D	L_N	L_{max} (Source)	L_{min} (Source)	Estimated L_{dn}*
	COUNTY RURAL AREAS					
13	Union Rd. and Geneseo Rd.	43	39	61 (traffic)	30 (wind)	44-48 dB
	PASO ROBLES					
21	Vine St. and 28th St. **	53	46	83	28	52-56 dB
22	Turtle Creek Park	44	35	56 (industrial)	33 (dist. traffic)	42-46 dB
23	Centennial Park	45	38	61 (traffic)	35 (dist. traffic)	44-48 dB
24	Call-Booth House (N.W. corner of Vine and 13th)	50	39	69 (traffic)	37 (dist. traffic)	48-52 dB

L_D = Average Leq of two 15-minute samples obtained between 7:00 a.m. and 10:00 p.m. except for sites where 24-hour monitoring was conducted.

L_N = Leq for one 15-minute sample obtained between 10:00 p.m. and 7:00 a.m. except for sites where 24-hour monitoring was conducted.

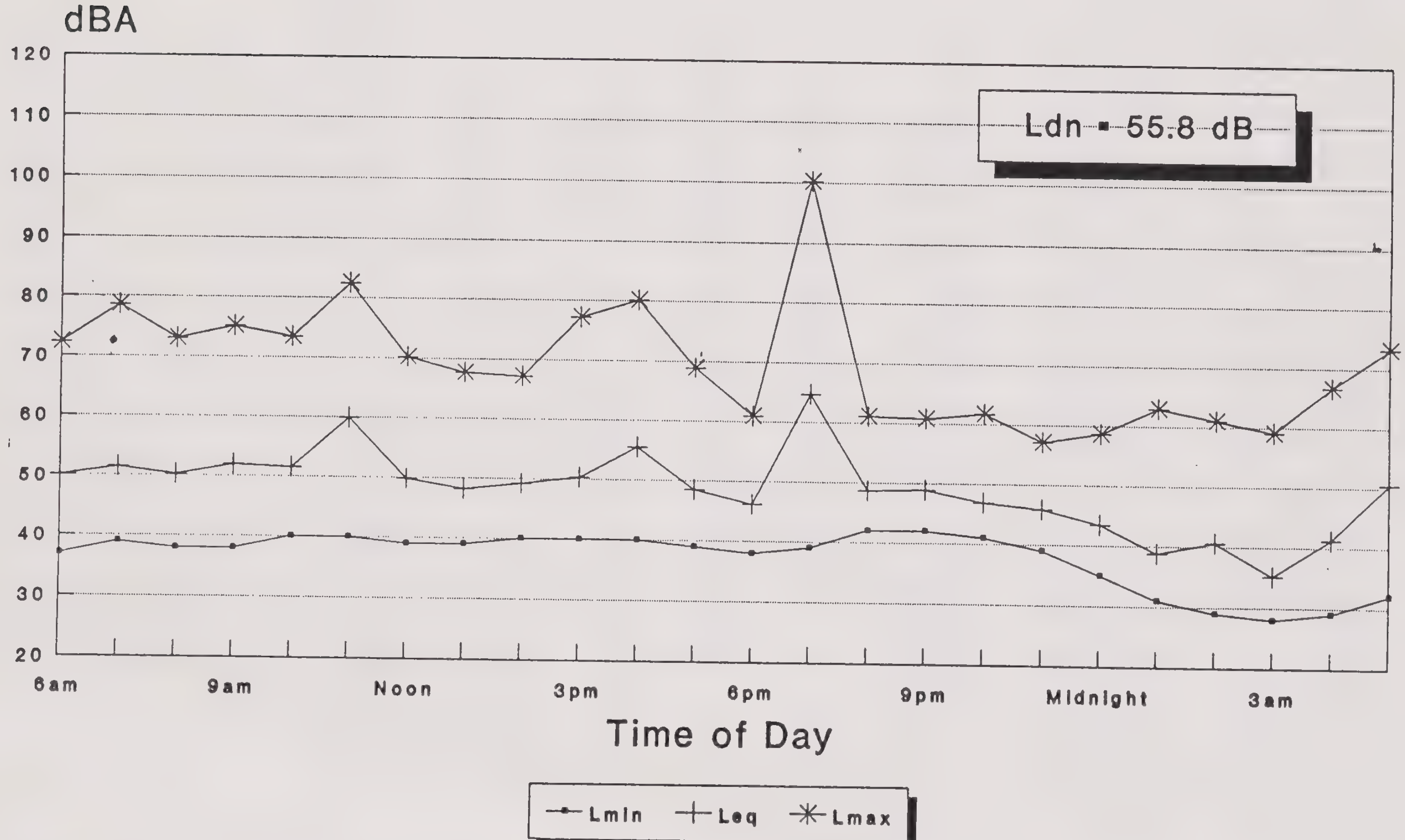
* L_{dn} estimated from L_D and L_N

** L_{dn} 24-hour monitoring site

Source: Brown-Buntin Associates, Inc.

Figure 4-2

Ambient Noise Levels
City of Paso Robles



N.E. Cor. 28th & Vine 8/21-22/90

BBA

5.0 REFERENCES

1. California Department of Health Services, *Guidelines for the Preparation and Content of the Noise Elements of the General Plan*, 1990 (included in the 1990 State of California General Plan Guidelines, State Office of Planning and Research).

2. U.S. Environmental Protection Agency, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, March, 1974.

3. California Department of Health, Office of Noise Control, *Model Community Noise Control Ordinance*, April, 1977.

4. U.S. Environmental Protection Agency, *Model Community Noise Control Ordinance*, September, 1975.

5. Federal Highway Administration, *FHWA Highway Traffic Noise Prediction Model*, December, 1978.

6. Brown-Buntin Associates, Inc., *Aircraft Noise Assessment, Chandler Ranch Specific Plan EIR*, July, 1990.

7. Federal Aviation Administration, *Integrated Noise Model, Version 3.9*, October, 1982.

8. Department of the Army, *Environmental Noise Study No. 52-34-0493-89, Noise Contours for Camp Roberts, California*, June, 1989.

APPENDIX A

TRAFFIC DATA

NOTE: This appendix contains information for the County of San Luis Obispo as a whole. The "Segments" correspond to the "Segment Numbers" listed in Table 3-4 on pages 3-10 and 3-11.

BBA

..WA Model RD-77-108: Brown-Buntin Associates, Inc.
alveno Emission Curves   Run Date: 05-15-1991
roject Number: 90-001   Run Time: 15:14:13
ear: 1991
oft Site

NPUT DATA SUMMARY:

egment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
1	3800	90.0	0.0	10.0	5.0	2.1	50.0	100.0	0.0
2	6500	90.0	0.0	10.0	5.0	2.1	50.0	100.0	0.0
3	5800	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
4	10300	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
5	7400	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
6	12700	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
7	12400	89.0	0.0	11.0	1.5	0.7	40.0	100.0	0.0
8	19700	89.0	0.0	11.0	1.5	0.7	40.0	100.0	0.0
9	30000	87.0	0.0	13.0	1.9	0.9	45.0	100.0	0.0
10	44300	87.0	0.0	13.0	1.9	0.9	45.0	100.0	0.0
11	21000	85.0	0.0	15.0	3.0	1.2	65.0	100.0	0.0
12	32800	85.0	0.0	15.0	3.0	1.2	65.0	100.0	0.0
13	17800	88.0	0.0	12.0	3.3	1.5	70.0	100.0	0.0
14	27800	88.0	0.0	12.0	3.3	1.5	70.0	100.0	0.0
15	21700	90.0	0.0	10.0	2.4	0.8	70.0	100.0	0.0
16	30900	90.0	0.0	10.0	2.4	0.8	70.0	100.0	0.0
17	15000	90.0	0.0	10.0	2.9	0.8	70.0	100.0	0.0
18	21000	90.0	0.0	10.0	2.9	0.8	70.0	100.0	0.0
19	8200	95.0	0.0	5.0	4.4	1.2	65.0	100.0	0.0
20	9500	95.0	0.0	5.0	4.4	1.2	65.0	100.0	0.0
21	6500	95.0	0.0	5.0	5.1	2.2	65.0	100.0	0.0
22	8600	95.0	0.0	5.0	5.1	2.2	65.0	100.0	0.0
23	8000	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
24	9800	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
25	2500	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
26	3700	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
27	9000	90.0	0.0	10.0	3.0	1.2	55.0	100.0	0.0
28	17400	90.0	0.0	10.0	3.0	1.2	55.0	100.0	0.0
29	6000	90.0	0.0	10.0	2.7	1.6	55.0	100.0	0.0
30	9400	90.0	0.0	10.0	2.7	1.6	55.0	100.0	0.0
31	11900	90.0	0.0	10.0	2.7	1.6	45.0	100.0	0.0
32	30500	90.0	0.0	10.0	2.7	1.6	45.0	100.0	0.0
33	25000	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
34	46100	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
35	2800	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
36	4800	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
37	1900	90.0	0.0	10.0	2.3	1.2	45.0	100.0	0.0
38	3000	90.0	0.0	10.0	2.3	1.2	45.0	100.0	0.0
39	560	90.0	0.0	10.0	10.4	3.1	45.0	100.0	0.0
40	1100	90.0	0.0	10.0	10.4	3.1	45.0	100.0	0.0
41	4300	84.0	0.0	16.0	5.6	8.7	60.0	100.0	0.0
42	7900	84.0	0.0	16.0	5.6	8.7	60.0	100.0	0.0
43	2100	94.0	0.0	6.0	2.4	1.1	65.0	100.0	0.0
44	2600	94.0	0.0	6.0	2.4	1.1	65.0	100.0	0.0
45	3900	94.0	0.0	6.0	2.8	1.2	60.0	100.0	0.0

WA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 05-15-1991
Project Number: 90-001   Run Time: 15:14:16
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
46	5000	94.0	0.0	6.0	2.8	1.2	60.0	100.0	0.0
47	16000	85.0	0.0	15.0	8.6	11.4	65.0	100.0	0.0
48	23400	85.0	0.0	15.0	8.6	11.4	65.0	100.0	0.0
49	10000	81.0	0.0	19.0	8.3	12.5	65.0	100.0	0.0
50	17000	81.0	0.0	19.0	8.3	12.5	65.0	100.0	0.0
51	5200	84.0	0.0	16.0	5.8	18.2	65.0	100.0	0.0
52	8840	84.0	0.0	16.0	5.8	18.2	65.0	100.0	0.0
53	5100	88.0	0.0	12.0	3.5	2.5	60.0	100.0	0.0
54	8500	88.0	0.0	12.0	3.5	2.5	60.0	100.0	0.0
55	2400	88.0	0.0	12.0	3.0	3.0	60.0	100.0	0.0
56	4000	88.0	0.0	12.0	3.0	3.0	60.0	100.0	0.0
57	40000	89.0	0.0	11.0	2.2	5.3	70.0	100.0	0.0
58	66800	89.0	0.0	11.0	2.2	5.3	70.0	100.0	0.0
59	52000	90.0	0.0	10.0	2.3	5.3	70.0	100.0	0.0
60	133200	90.0	0.0	10.0	2.3	5.3	70.0	100.0	0.0
61	45000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
62	95700	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
63	50000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
64	83800	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
65	43000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
66	73000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
67	56000	90.0	0.0	10.0	2.7	6.3	70.0	100.0	0.0
68	100200	90.0	0.0	10.0	2.7	6.3	70.0	100.0	0.0
69	44000	89.0	0.0	11.0	3.0	7.0	70.0	100.0	0.0
70	102000	89.0	0.0	11.0	3.0	7.0	70.0	100.0	0.0
71	33000	86.0	0.0	14.0	3.0	6.6	70.0	100.0	0.0
72	69900	86.0	0.0	14.0	3.0	6.6	70.0	100.0	0.0
73	24000	86.0	0.0	14.0	3.9	8.5	65.0	100.0	0.0
74	53900	86.0	0.0	14.0	3.9	8.5	65.0	100.0	0.0
75	17000	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
76	30200	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
77	15500	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
78	30200	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
79	2450	90.0	0.0	10.0	5.6	16.0	60.0	100.0	0.0
80	3400	90.0	0.0	10.0	5.6	16.0	60.0	100.0	0.0
81	3000	91.0	0.0	9.0	4.3	1.7	50.0	100.0	0.0
82	6700	91.0	0.0	9.0	4.3	1.7	50.0	100.0	0.0
83	11000	92.0	0.0	8.0	4.3	1.7	50.0	100.0	0.0
84	23900	92.0	0.0	8.0	4.3	1.7	50.0	100.0	0.0
85	21900	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
86	40000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
87	29000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
88	52000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
89	10400	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
90	17000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0

WA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 05-15-1991
Project Number: 90-001   Run Time: 15:14:18
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
91	14300	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.0
92	29000	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.0
93	17000	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.0
94	30000	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.0
95	17000	90.0	0.0	10.0	2.5	2.5	36.0	100.0	0.0
96	30000	90.0	0.0	10.0	2.5	2.5	36.0	100.0	0.0
97	10100	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
98	20000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
99	8500	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
100	11000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
101	13000	90.0	0.0	10.0	2.5	2.5	52.0	100.0	0.0
102	22000	90.0	0.0	10.0	2.5	2.5	52.0	100.0	0.0
103	2800	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
104	7000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
105	3300	90.0	0.0	10.0	1.0	1.0	41.0	100.0	0.0
106	5500	90.0	0.0	10.0	1.0	1.0	41.0	100.0	0.0
107	2900	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
108	6000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
109	3000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
110	5000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
111	6100	90.0	0.0	10.0	1.0	1.0	32.0	100.0	0.0
112	10500	90.0	0.0	10.0	1.0	1.0	32.0	100.0	0.0
113	5800	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
114	8000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
115	6300	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
116	10500	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
117	4500	90.0	0.0	10.0	1.0	1.5	39.0	100.0	0.0
118	17000	90.0	0.0	10.0	1.0	1.5	39.0	100.0	0.0
119	5500	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
120	12000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
121	4200	90.0	0.0	10.0	1.0	1.0	31.0	100.0	0.0
122	13000	90.0	0.0	10.0	1.0	1.0	31.0	100.0	0.0
123	3600	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
124	7300	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
125	2800	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
126	5400	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
127	5237	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
128	5110	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
129	5237	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
130	15260	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
131	5190	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
132	6380	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
133	5190	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
134	27650	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
135	3800	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 05-15-1991
Project Number: 90-001   Run Time: 15:14:22
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
136	7410	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
137	4600	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.0
138	12100	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.0
139	4600	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.0
140	18180	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.0
141	4400	90.0	0.0	10.0	5.0	5.0	45.0	100.0	0.0
142	10000	90.0	0.0	10.0	5.0	5.0	45.0	100.0	0.0
143	5900	88.0	0.0	12.0	1.0	1.0	50.0	100.0	0.0
144	13000	88.0	0.0	12.0	1.0	1.0	50.0	100.0	0.0
145	11000	86.0	0.0	14.0	3.0	3.1	50.0	100.0	0.0
146	19500	86.0	0.0	14.0	3.0	3.1	50.0	100.0	0.0
147	2900	90.0	0.0	10.0	1.0	1.0	60.0	100.0	0.0
148	6000	90.0	0.0	10.0	1.0	1.0	60.0	100.0	0.0
149	2300	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.0
150	6500	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.0
151	2500	90.0	0.0	10.0	8.5	10.0	50.0	100.0	0.0
152	4000	90.0	0.0	10.0	8.5	10.0	50.0	100.0	0.0
153	3000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
154	6000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
155	6500	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
156	7000	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
157	5200	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.0
158	6000	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.0
159	23000	92.0	0.0	8.0	0.5	0.5	60.0	100.0	0.0
160	32000	92.0	0.0	8.0	0.5	0.5	60.0	100.0	0.0
161	14300	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.0
162	29000	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.0
163	11000	92.0	0.0	8.0	5.0	6.4	45.0	100.0	0.0
164	18000	92.0	0.0	8.0	5.0	6.4	45.0	100.0	0.0
165	2000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
166	16000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
167	5200	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.0
168	24000	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.0
169	3600	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.0
170	12000	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.0
171	5700	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.0
172	8100	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.0
173	3000	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
174	10000	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
175	4300	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
176	6500	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
177	3400	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
178	6800	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
179	3200	90.0	0.0	10.0	1.0	1.0	38.0	100.0	0.0
180	7800	90.0	0.0	10.0	1.0	1.0	38.0	100.0	0.0

.JA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 05-15-1991
Project Number: 90-001   Run Time: 15:14:24
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
181	3600	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
182	3600	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
183	10400	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
184	17000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
185	29000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
186	52000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
187	21900	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
188	40000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
189	4100	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
190	10000	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
191	16400	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
192	24000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
193	12300	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
194	12000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
195	2700	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
196	16000	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
197	11500	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
198	15000	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
199	2700	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
200	8000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
201	8900	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
202	12000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
203	11400	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
204	32000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
205	11400	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
206	17000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
207	12800	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
208	18000	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
209	15000	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
210	40000	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
211	15000	92.0	0.0	8.0	1.5	2.0	40.0	100.0	0.0
212	31000	92.0	0.0	8.0	1.5	2.0	40.0	100.0	0.0
213	12600	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
214	19000	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
215	18000	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
216	20000	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
217	21000	92.0	0.0	8.0	1.5	1.5	40.0	100.0	0.0
218	34000	92.0	0.0	8.0	1.5	1.5	40.0	100.0	0.0
219	4800	92.0	0.0	8.0	1.0	1.0	40.0	100.0	0.0
220	15000	92.0	0.0	8.0	1.0	1.0	40.0	100.0	0.0
221	18000	92.0	0.0	8.0	1.5	1.5	35.0	100.0	0.0
222	29000	92.0	0.0	8.0	1.5	1.5	35.0	100.0	0.0
223	23000	92.0	0.0	8.0	0.5	0.5	45.0	100.0	0.0
224	32000	92.0	0.0	8.0	0.5	0.5	45.0	100.0	0.0
225	33000	92.0	0.0	8.0	1.5	2.0	45.0	100.0	0.0

/A Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 05-15-1991
Project Number: 90-001   Run Time: 15:15:22
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
226	51000	92.0	0.0	8.0	1.5	2.0	45.0	100.0	0.0
227	16200	92.0	0.0	8.0	1.0	1.0	30.0	100.0	0.0
228	23000	92.0	0.0	8.0	1.0	1.0	30.0	100.0	0.0
229	12900	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
230	20000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
231	12700	92.0	0.0	8.0	1.5	1.5	30.0	100.0	0.0
232	14000	92.0	0.0	8.0	1.5	1.5	30.0	100.0	0.0
233	15100	92.0	0.0	8.0	2.0	2.0	30.0	100.0	0.0
234	23000	92.0	0.0	8.0	2.0	2.0	30.0	100.0	0.0
235	16800	89.0	0.0	11.0	1.5	0.7	35.0	100.0	0.0
236	28000	89.0	0.0	11.0	1.5	0.7	35.0	100.0	0.0
237	13500	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
238	27000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
239	9700	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
240	19000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
241	14000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
242	23000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
243	2000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
244	16000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
245	2900	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
246	5800	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
247	3600	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
248	4300	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
249	3000	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
250	4000	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
251	4100	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
252	32000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
253	5900	93.0	0.0	7.0	1.0	1.0	40.0	100.0	0.0
254	17200	93.0	0.0	7.0	1.0	1.0	40.0	100.0	0.0
255	11100	93.0	0.0	7.0	2.0	2.0	35.0	100.0	0.0
256	32400	93.0	0.0	7.0	2.0	2.0	35.0	100.0	0.0
257	9200	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
258	26700	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
259	6600	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
260	19100	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
261	7900	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
262	22900	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
263	5900	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
264	17200	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
265	15100	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
266	43800	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
267	10500	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
268	30500	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
269	5200	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
270	15200	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0

A Model RD-77-108: Brown-Buntin Associates, Inc.
alveno Emission Curves   Run Date: 05-15-1991
roject Number: 90-001   Run Time: 15:16:27
ear: 1991
oft Site

NPUT DATA SUMMARY:

egment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
271	16400	93.0	0.0	7.0	2.0	2.0	40.0	100.0	0.0
272	47700	93.0	0.0	7.0	2.0	2.0	40.0	100.0	0.0
273	6300	93.0	0.0	7.0	1.0	1.0	30.0	100.0	0.0
274	18300	93.0	0.0	7.0	1.0	1.0	30.0	100.0	0.0
275	3000	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
276	8800	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
277	12686	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
278	18000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
279	12980	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
280	19500	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
281	28167	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
282	42250	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
283	7000	90.0	0.0	10.0	5.0	1.6	35.0	100.0	0.0
284	8200	90.0	0.0	10.0	5.0	1.6	35.0	100.0	0.0
285	3700	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
286	6200	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
287	6100	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
288	7100	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
289	17000	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
290	22000	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
291	2320	90.0	0.0	10.0	0.1	0.1	35.0	100.0	0.0
292	5000	90.0	0.0	10.0	0.1	0.1	35.0	100.0	0.0
293	6400	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
294	7400	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
295	13400	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
296	73700	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
297	9500	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
298	41900	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
299	900	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
300	33800	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
301	15700	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
302	26500	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
303	5000	90.0	0.0	10.0	2.0	2.0	45.0	100.0	0.0
304	54700	90.0	0.0	10.0	2.0	2.0	45.0	100.0	0.0
305	2000	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
306	11000	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
307	3400	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
308	16700	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
309	6800	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
310	16900	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
311	2400	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
312	5400	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
313	3400	90.0	0.0	10.0	2.0	2.0	40.0	100.0	0.0
314	6500	90.0	0.0	10.0	2.0	2.0	40.0	100.0	0.0
315	5613	93.0	0.0	7.0	1.0	1.0	33.0	100.0	0.0

I A Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 05-15-1991
Project Number: 90-001   Run Time: 15:17:32
Year: 1991
Soft Site

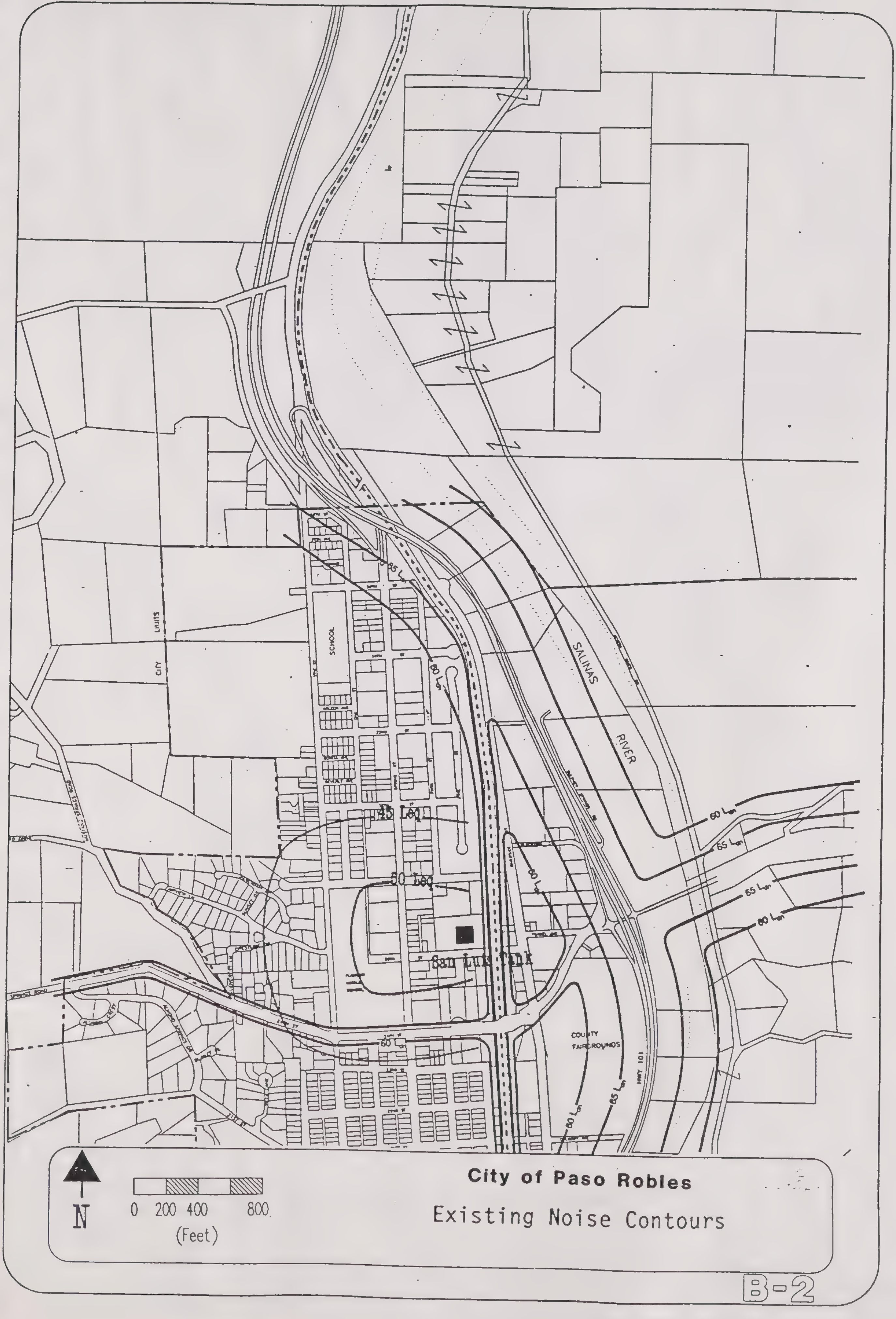
INPUT DATA SUMMARY:

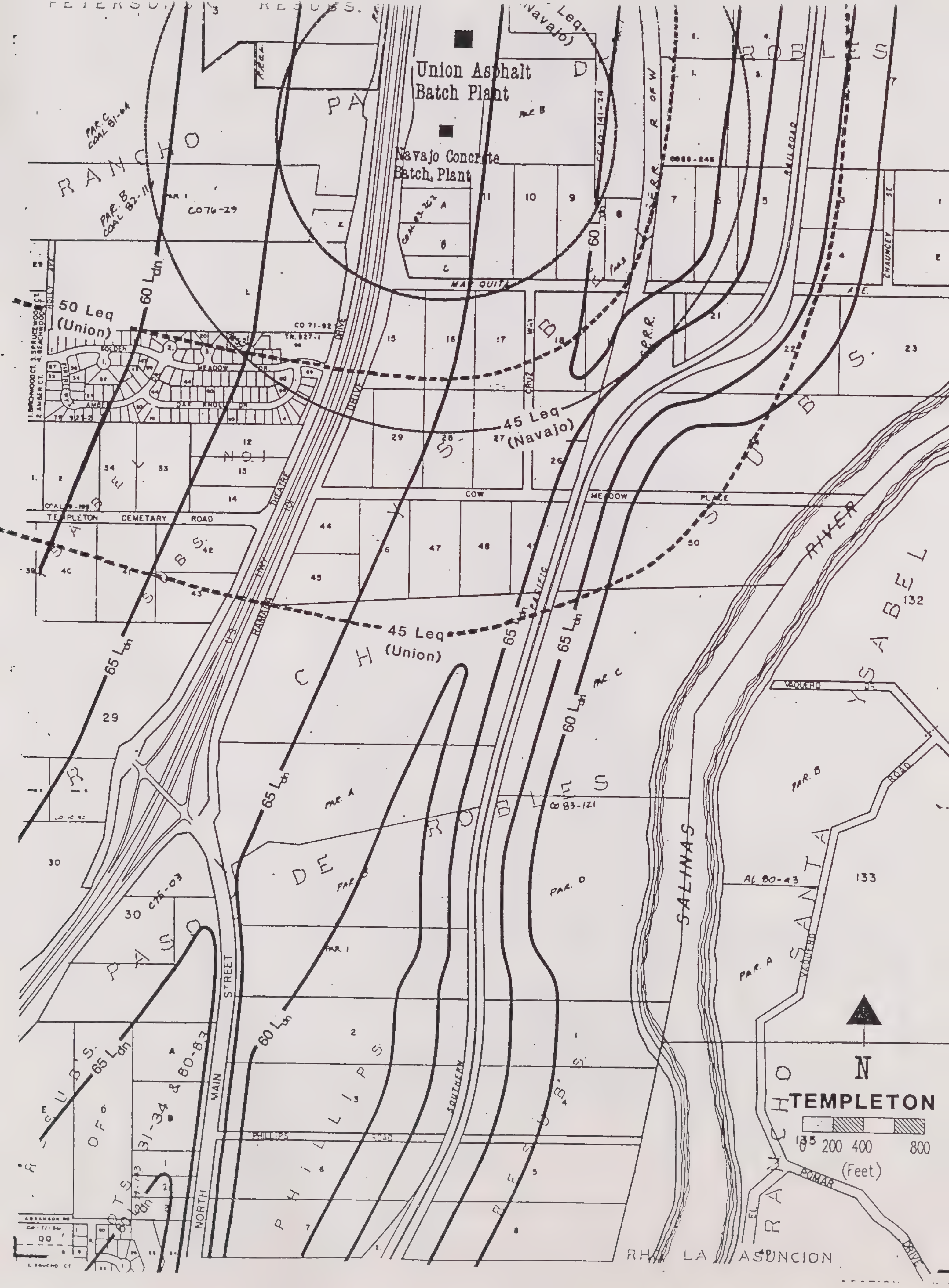
Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
316	8000	93.0	0.0	7.0	1.0	1.0	33.0	100.0	0.0
317	3641	90.0	0.0	10.0	1.0	1.0	42.0	100.0	0.0
318	5200	90.0	0.0	10.0	1.0	1.0	42.0	100.0	0.0
319	31971	94.0	0.0	6.0	1.0	1.0	31.0	100.0	0.0
320	45400	94.0	0.0	6.0	1.0	1.0	31.0	100.0	0.0
321	11610	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
322	16500	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
323	10899	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
324	15500	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
325	10855	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
326	15500	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
327	7833	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
328	11200	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
329	12618	95.0	0.0	5.0	1.0	1.0	32.0	100.0	0.0
330	18000	95.0	0.0	5.0	1.0	1.0	32.0	100.0	0.0
331	7747	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
332	11000	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
333	6314	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
334	9000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
335	9300	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
336	18000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
337	9300	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
338	18000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
339	9250	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
340	12900	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
341	3500	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
342	5000	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
343	6380	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
344	9800	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
345	4440	90.0	0.0	10.0	1.8	5.4	35.0	100.0	0.0
346	6660	90.0	0.0	10.0	1.8	5.4	35.0	100.0	0.0

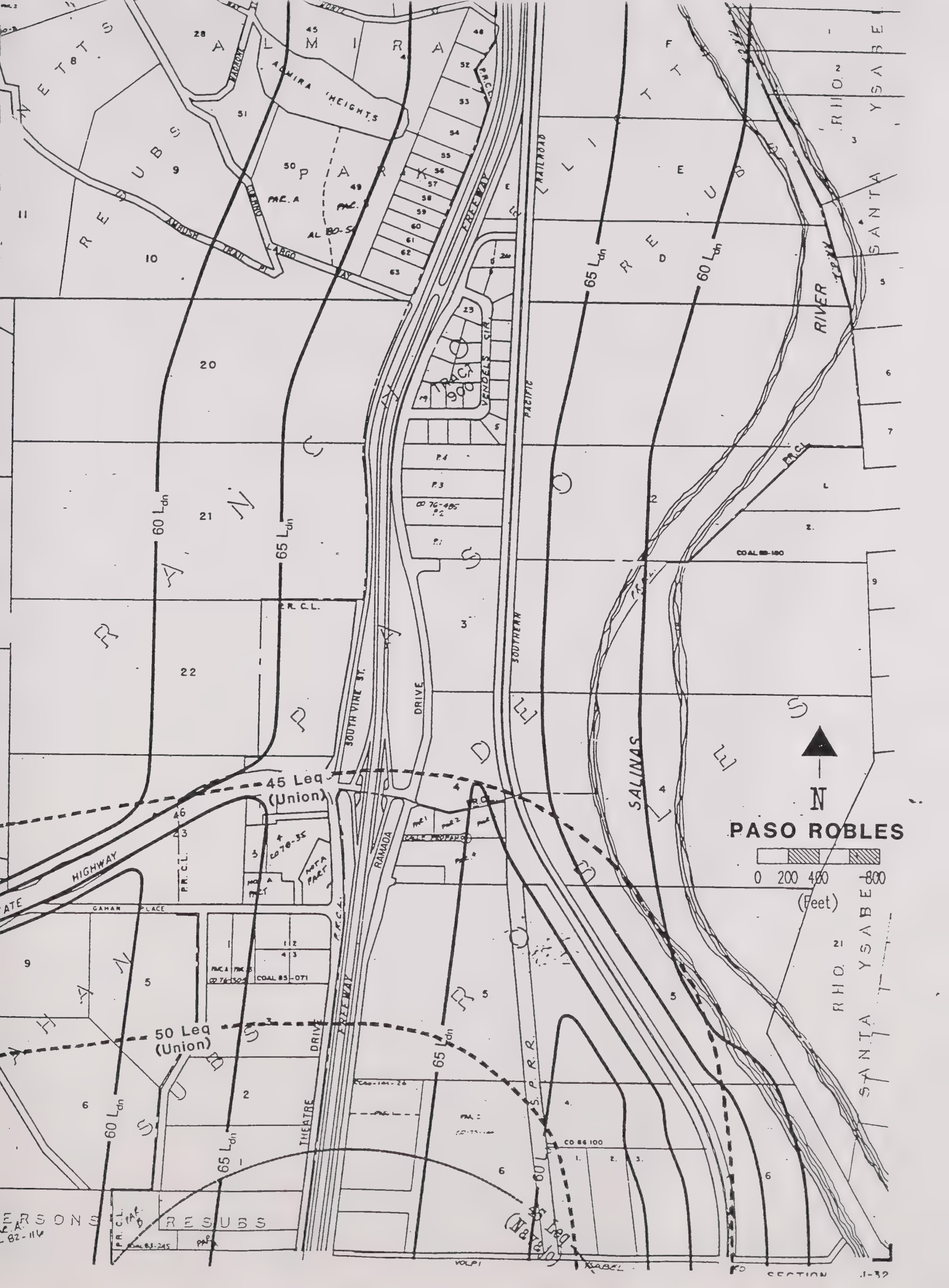
APPENDIX B

STATIONARY NOISE SOURCES

BBA


SALINAS
RIVER
SCHOOL
CITY
LIMITS
COUNTY
FAIRGROUNDS
HWY 101
65 Leq
60 Leq
San Luis Tank
65 Ldn
60 Ldn
N
0 200 400 800
(Feet)
City of Paso Robles
Existing Noise Contours


Union Asphalt
Batch Plant
Navajo Concrete
Batch Plant
Leq (Navajo)
50 Leq (Union)
45 Leq (Navajo)
45 Leq (Union)
60 Ldn
65 Ldn
TEMPLETON CEMETARY ROAD
COW MEADOW PLACE
MAIN STREET
NORTH MAIN STREET
SALINAS RIVER
SOUTHERN PACIFIC
RANCHO PASO DE ROBLES
PHILLIPS SUBS.
RHO LA ASUNCION
RANCHO SANTA YSABEL
N
TEMPLETON
0 200 400 800
(Feet)



45 Leq
(Union)
50 Leq
(Union)
60 Ldn
65 Ldn
FREEWAY
SOUTH VINE ST.
THEATRE
DRIVE
RAMADA
HIGHWAY
GAHAN PLACE
SOUTHERN
PACIFIC
RAILROAD
SALINAS
RIVER
N
PASO ROBLES
0 200 400 800
(Feet)


60 Ldn
65 Ldn
STATE HIGHWAY
50 Leq
(Union)
45 Leq
(Union)
PARCEL 1
PARCEL 2
NORTH BETHEL ROAD
HERDSMAN
WILD OATS WAY
COBBLE CREEK WAY
FRONTIER WAY
BRAMBLES CT.
10' WATER EASEMENT
TRACT
975
65
PTN.
ROSEMEAD
FARMS
GOLDEN MEADOW DRIVE
NO. 1
YSABEL
SUBS.
TEMPLETON ROAD
TR. 1464
TRACT
1142
PETERSEN RANCH ROAD
ABRAMSON
FREEWAY
N
TEMPLETON
0 200 400 800
(Feet)

NOISE ELEMENT
OF THE
GENERAL PLAN
OF THE
CITY OF EL PASO DE ROBLES

VOLUME III - ACOUSTIC DESIGN MANUAL

APRIL, 1994

NOISE ELEMENT OF THE GENERAL PLAN
CITY OF EL PASO DE ROBLES, CALIFORNIA

VOLUME III - ACOUSTICAL DESIGN MANUAL

APRIL, 1994

(Edited from a document prepared in September, 1991
by Brown-Buntin Associates, Inc.

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VISALIA, CALIFORNIA 93291

ACOUSTICAL DESIGN MANUAL-NOISE ELEMENT, VOLUME III

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1.0 INTRODUCTION

1.1 Purpose and Limitations

This Acoustical Design Manual is adopted as a supporting document to, but not a part of, the Noise Element of the General Plan. The purpose of this manual is to provide county and city staff, developers, builders and homeowners with a guide for reducing outdoor and indoor noise exposure from traffic, railroads and aircraft to acceptable levels. The manual is not intended to address situations where noise is produced by stationary noise sources (e.g., power plants, mining operations or other commercial, industrial or agricultural operations). In addition, this manual should not be used to address complex acoustical situations where the noise source is at an elevation significantly different from the receiver or the noise source is shielded from the receiver by buildings or topography. Such situations should be studied by an acoustical expert.

Figure 1-1 is a flow chart which illustrates the process which should be followed to determine noise exposure and appropriate mitigation for residential uses. Non-residential uses are encouraged to follow the same procedure for interior space reductions. In order to protect the public health, safety and welfare, there may be instances in which the City may require noise barriers for non-residential uses such as parks and playgrounds.

It should be noted that an acoustical analysis prepared by a noise expert should only be required where noise levels appear to exceed the ability of standard noise reduction measures, as described in the Acoustic Design Manual, to reduce exterior and interior levels to City-adopted standards.

This manual contains standard noise mitigation packages which may be used to reduce exterior noise exposure by up to 5 dB and interior noise levels by 15, 20, 25, and 30 dB. The standard noise mitigation packages should be used with the noise exposure information contained within the Policy and Technical Reference Documents of the Noise Element to achieve compliance with the policies of the Noise Element in relatively simple situations. Standard noise mitigation packages may be prescribed in lieu of the requirement for a detailed acoustical analysis. See Figure 1-1 for the situations where the standard mitigation packages may be used.

FIGURE 1-1

PROCEDURE FOR DETERMINING MITIGATION FOR RESIDENTIAL* USES

1. Determine Noise Exposure for site (refer to Figure 2-1 for sources). NOTE: For traffic noise, future contours per Appendix B shall be used.

2. Outdoor Activity Areas: Does the noise level on any portion of the site that is proposed for outdoor activity areas exceed 65 dbA?

   No? - No exterior mitigation required. Interior mitigation may be required, however. Proceed to item #5.

   Yes? - Proceed to item #3.

3. Does the noise level in the outdoor activity areas exceed 70 dBA?

   No? - Proceed to item #4.

   Yes? - Since a barrier wall is expected to achieve only 5 dBA of noise reduction (which is insufficient to reduce noise levels to 65 dBA), an acoustical analysis and recommendations for appropriate mitigation measures, prepared by an expert shall be required. It shall be the responsibility of to the Community Development Director or his/her designee to determine if such analysis is required.

   Exceptions: (1) Where the noise source is aircraft noise and the residential is accessory to an agricultural, commercial, or industrial use, exterior noise reduction is not feasible and mitigation is not required; (2) If the Planning Commission or City Council finds that there is no feasible way to redesign the site (including provision of an open space buffer) to reduce exterior noise levels to 65 dBA or less, up to a maximum of an additional 3 dBA (i.e. up to 68 dBA) may be authorized without need to prepare an acoustical analysis.

4. Is the topographical relationship between the noise source and the outdoor activity area such that a line-of-sight analysis (as described in the Acoustic Design Manual) indicates that a noise barrier placed between the source and the outdoor activity area will effectively shield the outdoor activity area (thereby reducing noise levels to 65 dBA or less)?

   No? - An acoustical analysis prepared by an expert shall be required.

   Yes? - Provide an effective noise barrier as described in the Acoustic Design Manual. Such a barrier may consist of a masonry wall, earthen berm, or non-residential building (e.g. garage). NOTE: The City may require decorative masonry walls between residential uses and noise sources such as arterial streets, highways, railroads and stationary sources.

5. Interior Space: Does the noise level on any portion of the site that is proposed for dwelling units exceed 60 dbA?

   No? - No interior mitigation required. (Compliance with building codes will achieve a noise level reduction of 15 dBA, which would reduce 60 dBA to 45 dBA.)

   Yes? - Proceed to Item #6.

6. Is the required noise level reduction (to achieve 45 dBA interior) more than 30 dBA?

   No? - Provide interior mitigation per Acoustic Design Manual.
   Yes? - An acoustical analysis prepared by an expert shall be required.

*** 5 or more units per site (would include 5 or more condominium units).**

2.0 TERMINOLOGY

The following section describes the acoustical terminology used in this manual. Unless otherwise stated, all sound levels referred to in this manual are A-weighted decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighting, as it provides a high degree of correlation with human annoyance and health effects.

COMMUNITY NOISE EQUIVALENT LEVEL, CNEL: The equivalent energy (or energy average) sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m. The CNEL is generally computed for annual average conditions.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DAY/NIGHT AVERAGE SOUND LEVEL, L_{dn}: The equivalent energy (or energy average) sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m. The L_{dn} is generally computed for annual average conditions.

NEW DEVELOPMENT: Projects requiring land use or building permits, but excluding remodelling or additions to existing structures. Also includes modifications to existing stationary noise sources that substantially increase noise levels.

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and L_{dn} contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL REDUCTION, NLR: The arithmetic difference between the level of sound outside and inside a structure measured in decibels. For example, if the sound level outside a house is 70 dB and the level inside a room of the house is 45 dB, the NLR is 25 dB (70-45=25).

RESILIENT CHANNEL (CLIP): A metal device that allows indirect attachment of an interior wall to a stud or a ceiling to a joist. Resilient channels improve the noise reduction capability of the wall or roof/ceiling assembly.

SOUND TRANSMISSION CLASS, STC: A single-number rating system for determining the amount of noise reduction provided by a window, door or other building component. The higher the STC rating, the more efficient the component will be in reducing noise. Windows and doors having a minimum STC rating are sometimes required to ensure that a building facade will achieve a minimum Noise Level Reduction (NLR). STC ratings may not be subtracted from exterior noise exposure values to determine interior noise exposure values.

3.0 DETERMINATION OF NOISE EXPOSURE

3.1 Noise Exposure Information

The noise exposure information contained within the Policy and Technical Reference Documents of the Noise Element should be used to determine project site noise exposure and whether or not the recommendations of this manual are applicable to a particular project. Noise exposure information is available from these documents for the major transportation noise sources identified for study at the time the Noise Element update was prepared. Noise exposure information is also available within these documents for a representative sampling of stationary noise sources. Since noise from most stationary sources is difficult to quantify, and there are probably significant stationary noise sources which were not included in the Noise Element, noise from stationary noise sources should be evaluated by an acoustical expert.

The chart shown in Figure 3-1 illustrates where noise exposure information for a particular location may be found. Noise exposure information may be used to determine if new development is consistent with the policies of the Noise Element. If the noise exposure of new development will exceed the thresholds for mitigation or the maximum allowable standards in Chapter 3 of the Policy Document, noise mitigation will be required.

3.2 Noise Source Characteristics

In determining the magnitude of noise impact and strategies for reducing noise impact, it is important to be aware of the characteristics of noise produced by different sources. The most important characteristics of the three transportation noise sources this manual has been designed to address are described below:

- **Traffic:** For purposes of noise assessment, traffic is divided into automobiles, medium trucks (those having only two axles) and heavy trucks (those with three or more axles). The effective heights of noise propagation from automobiles, medium trucks and heavy trucks are, respectively, 0, 2 and 8 feet above the crown of the road.

FIGURE 3-1

CHART FOR LOCATING NOISE EXPOSURE INFORMATION

Traffic Noise

1. Reduced noise contour maps in Appendix of Policy Document, or
2. Rolled full-scale noise contour maps, and
3. Table 2-1, adjusted as necessary per Table 2-2.

Railroad Noise

1. Reduced noise contour maps in Appendix of Policy Document, or
2. Rolled full-scale noise contour maps, and
3. Table 2-3.

Aircraft Noise

1. Reduced noise contour maps in Appendix of Policy Document, or
2. Rolled full-scale noise contour maps.

Stationary Noise

1. Noise contour maps in Appendix of Policy Document, or
2. Chapters 3.6 & 3.7 of Technical Reference Document.

- **Railroads:** The effective source height of railroad noise is mostly determined by noise emitted by the locomotive, which is generally assumed to be 10 feet above the rails. However, the effective height of noise for a locomotive blowing its horn is increased to 15 feet above the rails since the horn is situated on top of the locomotive. In many situations the effective source height of trains is even greater than the heights noted above since the rails rest on a gravel bed that is often three or more feet higher than surrounding terrain.

- **Aircraft:** Aircraft in flight near an airport are usually a few hundred to several thousand feet above the ground. When aircraft noise exposure is an issue, generally the aircraft are overhead or are at least 30 degrees above the horizon. In such situations, the use of barriers to reduce exterior noise levels is not feasible.

4.0 NOISE MITIGATION

4.1 Site Design:

The preferable form of noise mitigation is the effective design of a project so that noise-sensitive uses are not located in areas exposed to excessive noise levels. This may be accomplished by using building setbacks, natural topography, building orientation, and intervening buildings which do not contain noise-sensitive land uses to reduce noise exposure at the receiving location. Such measures may minimize or eliminate the need to construct noise barriers, or to acoustically treat buildings.

Appendix A of this manual provides an overview of the various techniques available for noise mitigation. The information contained within Appendix A should be used in a general way to evaluate the acoustical effectiveness of project site designs and noise mitigation measures proposed to achieve compliance with the policies of the Noise Element. It should be understood that there is no simple way to determine with certainty if a site design will succeed in adequately reducing noise exposure, unless an acoustical analysis of the project is performed by an expert. If there is a question about the effectiveness of proposed noise mitigation measures, the reviewing agency may require an acoustical analysis or apply the standard noise mitigation packages described below.

4.2 Standard Noise Mitigation Packages

In situations where buildings containing noise-sensitive land uses or outdoor activity areas are proposed for locations where noise levels exceed the standards of the Noise Element, noise mitigation will be required as a part of the project approval or building permit process. Figure 1-1 illustrates the process which should be followed to determine noise exposure and appropriate mitigation for residential uses. Non-residential uses are encouraged to follow the same procedure for interior space reductions. In order to protect the public health, safety and welfare, there may be instances in which the City may require noise barriers for non-residential uses such as parks and playgrounds.

It should be noted that an acoustical analysis prepared by a noise expert should only be required where noise levels appear to exceed the ability of standard noise reduction measures, as described in the Acoustic Design Manual, to reduce exterior and interior levels to City-adopted standards.

Standard noise mitigation packages are sets of noise mitigation measures which may be used to reduce exterior or interior noise exposure by prescribed amounts. The standard noise mitigation packages contained within this manual are intended for the reduction of exterior noise exposure in outdoor activity areas or

at building facade locations by up to 5 dB. Reductions greater than this are significantly more difficult to achieve, and should be based upon the recommendations of an expert after a detailed study has been performed.

For interior noise exposure, standard noise mitigation packages to achieve outdoor to indoor noise level reductions (NLR) of 15, 20, 25 and 30 dB have been developed. Since these are generalized packages intended to address a variety of specific conditions, a conservative approach has been taken. This means that some of the components specified in the packages could possibly be modified or eliminated to achieve the prescribed NLR values under certain conditions. For this reason, the recommendations from an acoustical expert who has conducted a detailed study of a particular situation may differ somewhat from the standardized packages and yet achieve the desired results.

4.2.1 Mitigation in Outdoor Activity Areas

The following standard noise mitigation packages may be implemented to reduce exterior noise levels by approximately 5 dB.

- **Traffic Noise Sources:** Construct a barrier of sufficient height to interrupt line-of-sight between the source and receiver. For roadways where trucks are less than 5% of the Average Daily Traffic (ADT), a source height of 2 feet above the crown of the roadway should be used. For roadways where trucks are 5% or more of the ADT, a source height of 8 feet above the crown of the roadway should be used. In both cases, a receiver height of 5 feet above the grade of the location of the outdoor activity area of concern or building pad elevation should be used.

- **Railroad Noise Sources:** Construct a barrier of sufficient height to interrupt line-of-sight between the source and receiver. Within 1000 feet of a railroad grade crossing, a noise source height of 15 feet above the rails should be assumed. At other locations, a noise source height of 10 feet above the rails should be assumed. When determining the total height of a railroad noise source, the height of the roadbed must be added to the source heights described above. A receiver height of 5 feet above the outdoor activity area of concern or building pad elevation should be used.

- **Aircraft Noise:** Mitigation of exterior noise exposure due to aircraft overflights is generally not possible.

- **Stationary Noise Sources:** Standard noise mitigation packages may be applied to stationary noise sources where a line-of-sight analysis can be performed for noise sources that are generally at ground level and consist of such activities as mechanical heating, ventilating and air conditioning

equipment, forklift and other mobile equipment operations (including parking lot sweeping), truck loading. Noise sources at higher elevations and specialized industrial noises (e.g. sand-blasting and metal stamping) should be addressed by an acoustical analysis.

The determination of whether a proposed barrier design will interrupt line-of-sight between the noise source and receiver should be based on the procedure described in Table 4-1. Such methods require the preparation of a scaled cross-section showing the relative heights of the source, proposed barrier and receiver, and the distances between the source and barrier and barrier and receiver. Figure 4-1 provides examples of noise barrier cross-sections for simple and more complex site conditions.

For a noise barrier to be effective, it must consist of massive, tight-fitting materials, such as a grouted concrete block or stucco wall. No openings or cracks may be present in the wall or at the ground/wall interface. Other noise barrier materials may be acceptable, but should be approved by a qualified acoustical expert. The use of wood for noise barriers is generally not recommended due to problems with warpage, shrinkage and deterioration over time.

Barriers are most effective when placed close to either the source or receiver. A barrier that breaks line-of-sight will reduce noise levels by about 5 dB. Barrier noise reductions ranging from 5 to 15 dB are more difficult to achieve, and the design of such barriers should be based on the recommendations of an expert who has prepared a site-specific study. Noise reductions greater than 15 dB from barriers are generally not feasible.

4.2.2 Interior Noise Mitigation:

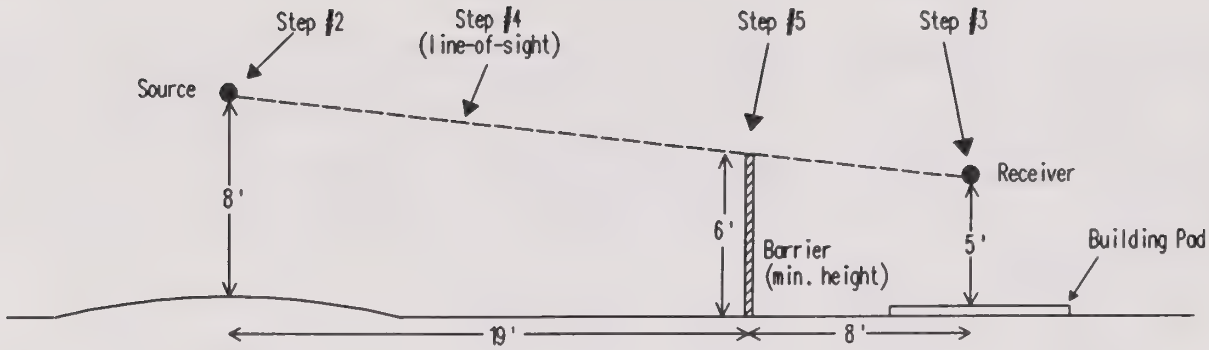
The most direct way to determine the interior noise level within a building is through noise level measurements. However, this is not possible if the structure has not yet been constructed. Also, it is generally not practical to perform interior noise level measurements within occupied buildings due to interference caused by activities within the structure and the length of time it takes to obtain representative results.

TABLE 4-1

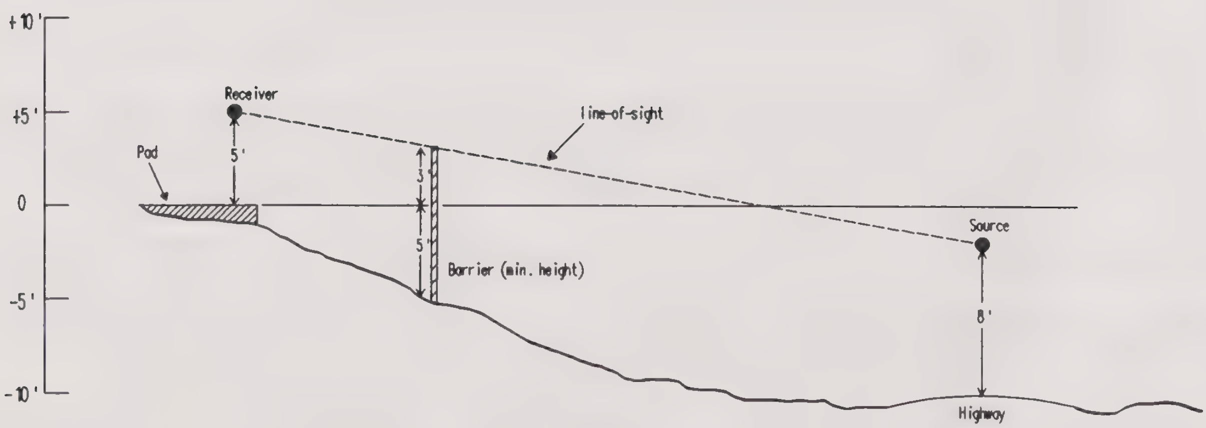
DETERMINATION OF NOISE BARRIER EFFECTIVENESS

Step #1:	Select an appropriate scale on graph paper to accommodate the distance from the noise source to receiver and the heights of the noise source and receiver (e.g. 1"=20', 1"=50', etc.).
Step #2:	Mark a point representing the effective height of the noise source above the crown of the road or top of the railroad track.
Step #3:	Scale off the distance from the noise source to the receiver and mark a point that is 5 feet above the building pad or outdoor activity area of concern.
Step #4:	Using a ruler, draw a straight line between the noise source and receiver. This line represents line-of-sight between the noise source and receiver (See Figure 4-1).
Step #5:	Determine the location of the proposed noise barrier between the noise source and receiver, and draw a vertical line that extends from the ground to a height that intercepts line-of-sight. The height of this line represents the <u>minimum</u> height of a noise barrier necessary to reduce exterior noise by approximately 5 decibels. Higher barriers will further reduce noise levels.

FIGURE 4-1



Example of Simple Barrier Situation
(may use standard noise mitigation packages)



Example of Complex Barrier Situation
(consult an acoustical expert)

Interior noise levels can be estimated if the exterior noise level is known and the outdoor to indoor NLR provided by the building is known. NLR is defined as the arithmetic difference between the level of sound outside and inside a structure, measured in decibels. For example, if the noise level outside a residence is 70 dB and the level inside a room of the residence is 45 dB, the NLR of the structure is 25 dB (70-45=25).

To satisfy the interior noise level standards of the Noise Element (see Table 2 in the Policy Document), the NLR provided by a building should equal or exceed the arithmetic difference between the exterior noise level at the building location and the required interior noise level. Referring to the example in the previous paragraph, if the exterior noise level is 70 dB L_{dn} and the required interior noise level is 45 dB L_{dn}, the minimum NLR of the structure must be 25 dB.

The following standard noise mitigation packages should be implemented to achieve NLR values of 15, 20, 25 and 30 dB. If an NLR greater than 30 dB is needed or if there is a question about the effectiveness of the standard noise mitigation packages in a particular situation, the reviewing agency may require that an acoustical analysis be conducted by an expert.

For all of the following noise mitigation packages, careful workmanship, including caulking of joints and base plates and installation of weather stripping, is essential to ensure the proper performance of building assemblies. Acoustical "leaks" in walls and roof/ceilings should be avoided by properly sealing penetrations and by eliminating flanking paths.

- **NLR of 15 dB**

Normal construction practices per the latest edition of the Uniform Building Code are sufficient to provide a NLR of 15 dB, even if windows or doors are partially open for ventilation.

- **NLR of 20 dB**

Normal construction practices per the latest edition of the Uniform Building Code are sufficient provided:

1) Air conditioning or a mechanical ventilation system is installed so that windows and doors may remain closed.

2) Windows and sliding glass doors are mounted in low air infiltration rate frames (0.5 cfm or less, per ANSI specifications).

3) Exterior doors are solid core with perimeter weather-stripping and threshold seals.

- **NLR of 25 dB**

Normal construction practices per the latest edition of the Uniform Building Code are sufficient provided:

1) Air conditioning or a mechanical ventilation system is installed so that windows and doors may remain closed.

2) Windows and sliding glass doors are mounted in low air infiltration rate frames (0.5 cfm or less, per ANSI specifications).

3) Exterior doors are solid core with perimeter weather stripping and threshold seals.

4) Exterior walls consist of stucco or brick veneer. Wood siding with a ½" minimum thickness fiberboard ("soundboard") underlayer may also be used.

5) Glass in both windows and doors should not exceed 20% of the floor area in a room.

6) Roof or attic vents facing the noise source should be baffled (see Appendix C for an example of a suitable vent treatment).

For aircraft noise exposure, all of the above plus:

1) Fireplaces should be fitted with tight-fitting dampers and glass doors.

2) Solid sheeting with a minimum thickness of ½" should underlay roofing materials.

3) Sky lights should not be allowed in occupied rooms.

- **NLR of 30 dB**

Normal construction practices per the latest edition of the Uniform Building Code are sufficient provided:

1) Air conditioning or a mechanical ventilation system is installed so that windows and doors may remain closed.

2) Windows and sliding glass doors are mounted in low air infiltration rate frames (0.5 cfm or less, per ANSI specifications).

3) Exterior doors are solid core with perimeter weather stripping and threshold seals.

4) Exterior walls consist of stucco or brick veneer.

5) Glass in both windows and doors should not exceed 20% of the floor area in a room.

6) Roof or attic vents facing the noise source should be baffled (see Appendix C for an example of a suitable vent treatment).

7) The interior sheetrock of exterior wall assemblies should be attached to studs by resilient channels. Staggered studs or double walls are acceptable alternatives.

8) Window assemblies should have a laboratory-tested STC rating of 30 or greater. (Windows that provide superior noise reduction capability and that are laboratory-tested are sometimes called "sound-rated" windows. In general, these windows have thicker glass and/or increased air space between panes. However, standard energy-conservation double-pane glazing with an 1/8" or 1/4" air space may be less effective in reducing noise from some noise sources than single-pane glazing).

For aircraft noise exposure, all of the above plus:

1) Fireplaces should not be allowed.

2) Solid sheeting with a minimum thickness of ½" should underlay roofing materials.

3) Ceilings should be attached to joists by resilient channels.

4) Sky lights should not be allowed in occupied rooms.

APPENDIX A

TECHNIQUES FOR NOISE CONTROL

Any noise problem may be considered as being composed of three basic elements: the noise source, a transmission path and a receiver. The emphasis of noise control in land use planning is usually placed upon acoustical treatment of the transmission path and the receiving structures.

The appropriate acoustical design for a given project should consider the nature of the noise source and the sensitivity of the receiver. The problem should be defined in terms of the noise level criteria (L_{dn}, L_{eq}, etc.) contained within the adopted policies of the Noise Element, the location of the sensitive receiver (inside or outside), and when the problem occurs (daytime or nighttime). Noise control techniques should then be selected to provide an acceptable noise environment for the receiving property while remaining consistent with local aesthetic standards and practical structural and economic limits. Basic noise control techniques include the following:

Use of Setbacks:

Noise exposure may be reduced by increasing the distance between the noise source and receiving use. Setback areas can take the form of open space, frontage roads, recreational areas, storage yards, and other non-noise sensitive uses. The amount of noise attenuation provided by this technique is limited by the characteristics of the site and the noise source. Each doubling of distance from the noise source will reduce noise exposure by about 4 to 6 dB.

Use of Barriers:

Shielding by barriers can be obtained by placing walls, earthen berms or other structures between the noise source and the receiver. The use of earthen berms may be acceptable but an acoustical expert should be consulted. The effectiveness of a barrier depends upon blocking line-of-sight between the source and receiver, and is improved with increases in the distance the sound must travel to pass over the barrier as compared to a straight line from source to receiver. The use of barriers to reduce noise is discussed in Chapter 4.2.1 where standard noise mitigation packages designed to reduce noise by a 5 decibels are recommended for certain prescribed situations. For situations other than those described in this Design Manual, the recommendations of an acoustical expert should be obtained.

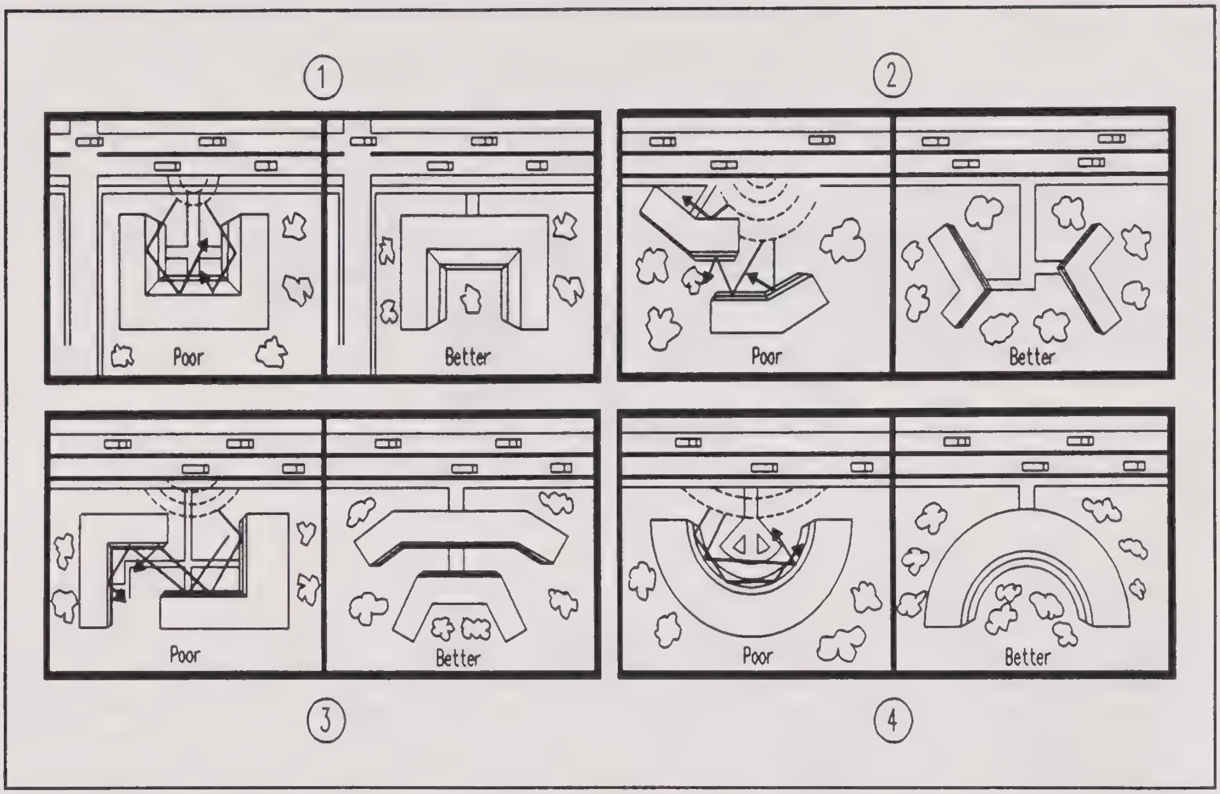
Building Location and Orientation:

Buildings containing noise-sensitive uses may be located on a site so that they are outside the area requiring noise mitigation. Buildings can be placed on a site to shield other structures or areas and to prevent an increase in noise level caused by reflections. The use of one building to shield another can significantly reduce overall project noise control costs, particularly if the shielding structure is insensitive to noise. As an example, carports or garages can be used to form or complement a barrier shielding adjacent dwellings or an outdoor activity area.

Similarly, one residential unit can be placed to shield another so that noise reduction measures are needed for only the building closest to the noise source. Placement of outdoor activity areas within the shielded portion of a building complex, such as a central courtyard, can be an effective method of providing a quiet retreat in an otherwise noisy environment. Patios or balconies should be placed on the side of a building opposite the noise source, and "wing walls" can be added to buildings or patios to help shield sensitive uses. Shielding by buildings can reduce noise impacts by up to 15 decibels. The exact amount of reduction depends on the efficiency of the design.

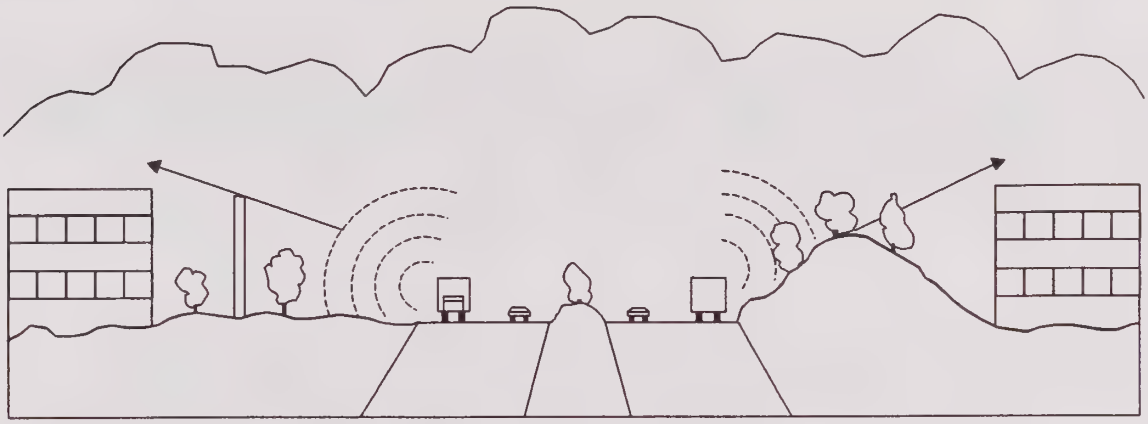
Where project design does not allow using buildings or other land uses to shield sensitive uses, noise control costs can be reduced by orienting buildings with the narrow end facing the noise source, thereby reducing total area of the building requiring acoustical treatment. Some examples of building orientation to reduce noise impacts are shown in Figure A-1.

FIGURE A-1



Another option in site design is the placement of relatively insensitive land uses, such as commercial, storage or parking areas, between the noise source and a more sensitive portion of the project. Examples include development of a commercial strip along a busy arterial to block noise affecting a residential area, or providing recreational vehicle storage along the noise-impacted edge of a mobile home park. If existing topography or development adjacent to the project site provides some shielding, as in the case of an existing berm, knoll or building, sensitive structures or activity areas may be placed behind those features to reduce noise control costs (Figure A-2).

FIGURE A-2



Site design should also guard against the creation of reflecting surfaces which may increase on-site noise levels. For example, two buildings placed at an angle facing a noise source may cause noise levels within that angle to increase by up to 3 dB (see example No. 3, Figure A-1). The open end of a "U"-shaped building should point away from noise sources for the same reason (see example No. 4, Figure A-1). Landscaping walls or noise barriers located within a development may inadvertently reflect noise back to a noise-sensitive area unless carefully located.

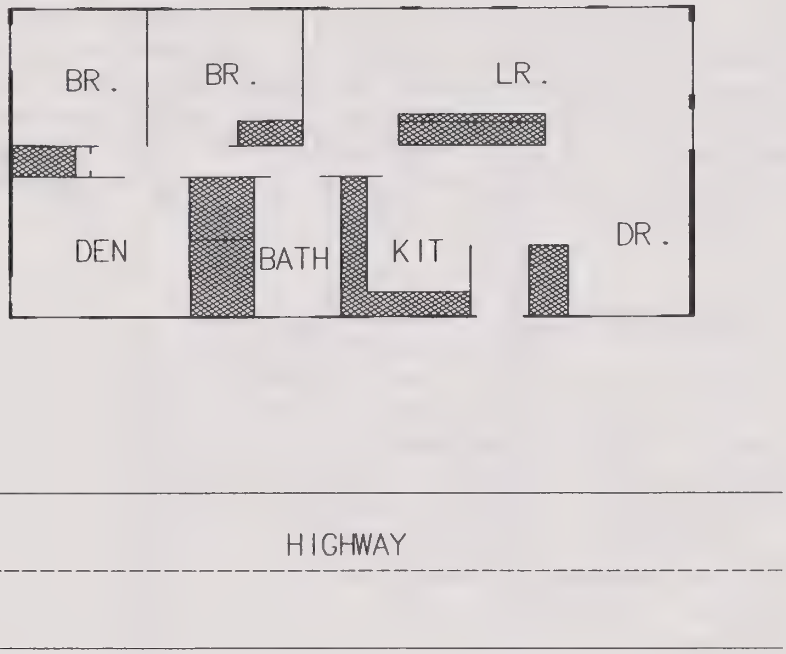
In some cases, external building facades can influence reflected noise levels affecting adjacent buildings. This is primarily a problem where high-rise buildings are proposed, and the effect is most evident in urban areas, where an "urban canyon" may be created. Bell-shaped or irregular building facades, setbacks and attention to building orientation can reduce this effect. Avoidance of these problems, as well as attaining an effective, aesthetic site design requires close coordination between local agencies, the project engineer and architect, and the acoustical consultant.

Acoustical Design of Buildings:

When structures have been located to provide maximum noise reduction by barriers or site design, noise reduction measures may still be required to achieve an acceptable interior noise environment. The cost of such measures may be reduced by the thoughtful placement of rooms. For example, bedrooms, living rooms, family rooms, and other noise-sensitive portions of a

dwelling can be located on the side of the unit farthest from the noise source, as shown by Figure A-3.

FIGURE A-3



Bathrooms, closets, stairwells and food preparation areas are relatively insensitive to exterior noise sources, and can be placed on the noisy side of a unit. When such techniques are employed, noise reduction requirements for the building facade can be significantly reduced, although the architect must take care to isolate the noise impacted areas by the use of partitions or doors.

When structures containing noise-sensitive uses are to be located in a noisy environment, interior noise exposure may be reduced through the acoustical design of building facades. Standard noise mitigation packages are recommended in this Design Manual for noise level reduction (NLR) values of 15, 20, 25 and 30 decibels. If an NLR greater than 30 decibels is required or if there is a question about the effectiveness of the standard noise mitigation packages in a certain situation, the reviewing agency may require an acoustical analysis.

<u>Use of Vegetation</u>:

It is sometimes assumed that trees and other vegetation can provide

significant noise attenuation. However, approximately 100 feet of dense foliage (so that no visual path extends through the foliage) is required to achieve a 5 dB attenuation of traffic noise. The use of vegetation as a noise barrier should not be considered a practical method of noise control unless large tracts of dense foliage are part of the existing landscape.

Vegetation can be used to acoustically "soften" intervening ground between a noise source and receiver by increasing ground absorption of sound. Vegetative barriers have been shown to reduce tire noise and other high frequency components of traffic noise. Planting of trees and shrubs is also of aesthetic and psychological value, and may reduce adverse public reaction to a noise source by removing the source from view, even though noise levels may be largely unaffected.

Sound Absorbing Materials:

Absorptive materials such as fiberglass, foam, cloth, and acoustical tiles are used to reduce reflections or reverberation in closed spaces. Their outdoor use is usually directed toward reducing reflections between parallel noise barriers or other reflective surfaces. Maintenance of absorptive materials used outdoors is difficult because such materials are easily damaged by sunlight and moisture. Their application as an outdoor noise control tool is limited to cases where the control of reflected noise is critical.

APPENDIX B

Example of Attic Vent Baffle Treatment